THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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LONDON ELECTRICITY SUPPLY AND THE L.C.C.

THE report of the Special Committee on Electricity Supply submitted to the London County Council meeting of July 4th is a document which defines in an instructive way the attitude of that body to any proposals made to reorganise and improve the electricity supply of London. The document was not, one imagines, designed as an act of self-revelation, but it serves that purpose all the better.

And it is a revelation which may well astound and perplex the reader who finds that the London County Council, the nearest thing to a representative central governing body vouchsafed to London, puts right into the background the first interest of its constituents in the subject of electricity supply. This interest, the supreme, immediate, and permanent interest of the inhabitants of this great area, eight million people, nearly one-fifth of the population of Great Britain, is a more abundant and a much cheaper supply of electricity than that now provided. It is unnecessary to tell the readers of the ELECTRICAL REVIEW what benefits will accrue to London if and when this need is met.

The L.C.C. takes a quite different view. The Report mentioned deals with two particular subjects. The first is the consent of the Electricity Commissioners to the erection of the County Company's station at Barking. The L.C.C. has opposed the granting of this consent from the first moment, and, finding the consent given despite its opposition, still cavils at the terms, and "regrets," in the words of the Report, that the consent should have been given before a Joint Electricity Board for London has been set up. The L.C.C. is a "bad loser." It is an open secret that the Commissioners' consent would have been given two years ago but for the opposition of the L.C.C. The L.C.C. considers itself better qualified than the Electricity Commissioners to decide what is the proper policy for London electricity, well qualified, as everyone admits that body to be, to do the work for which it was established.

The Report referred to makes it quite clear how this conflict of opinion arises. The Electricity Commissioners have one chief duty, it is that pointed out to them in the 1919 Act, to promote a "cheap and abundant supply of electricity." The L.C.C. takes a different view; it comes out again and again in this Report. It is the appointed purchaser of the London companies as so near a date as 1931. It has expressed its willingness to allow a joint electricity authority to succeed to this purchase right, and one cannot blame it for seeking to preserve the benefits of that right for its prospective successor. But that is not the first public interest; it is in the second rank at best. Yet the Report puts forward as its reason for objecting to the County Company's proposals, and to certain provisions of the Commissioners' consent thereto, that these will "prejudice the position" of the purchasing authority. What this really means, so far as one can judge, is that the purchasing authority will have more to buy and will therefore have more to pay for. It might surely have occurred to the Special Committee of the L.C.C. that under the terms of purchase set out in Section 2 of the 1888 Act, the purchaser will get the properties, bought at an extremely favourable price, without addition for prospective profits, and the more there is to buy the

bigger and the better the business bought. The L.C.C. has delayed the erection of the County Company's station for two years. It has by that time deferred the date at which that company's actual and potential consumers will get the benefit of that station, and if the people so deprived could be made to realise what the L.C.C. has done for them, they would let their members know in a very definite way their opinion of the notions of "public interest" which have been put in the forefront.

The other matter dealt with in the Report is the Commissioners' inquiry into the application of the S.E. & C. Railways and the West Kent Electric Co. to erect new stations, both intended to supply the S.E. & C. Railway load. Now, one can understand that the L.C.C., as a guardian of the public interests, instructed counsel to attend this inquiry and to put its views before the Commissioners. Why it should have opposed the West Kent Company's application *in toto* is not clear. That it should have asked the Commissioners, if they saw fit to grant the application, to attach conditions to it is reasonable. But the attitude and utterances of counsel for the L.C.C. on other points were more amazing. He acted under instructions, and there can be no personal reflection upon him. In the course of the inquiry the County of London Company put forward an offer to supply the railway load from the Barking station. Counsel for the L.C.C. cross-examined the witness for the County Company far more severely than did counsel for the railway company, and in his speech besought the Commissioners to do nothing which would permit such a supply. He suggested that it would be an infraction of the terms of the Commissioners' consent to the Barking scheme, which one would have thought the Commissioners capable of looking after for themselves. Again, why? Because such an extension of the Barking business would "prejudice the position of the purchasing authority," and would fetter the future joint electricity authority in its policy. Not until the very end of his speech, and then only in reply to a direct question from the Chief Commissioner, did counsel say that his instructions were that the Council offered no objection to the erection of a station by the railway companies for their own supply.

These two things must be taken together. It is a duty of the Commissioners to direct the early policy of the Joint Electricity Authority; the Commissioners have already plainly stated that it is in the interests of the London supply that the railway loads shall be taken by stations for general supply; and the L.C.C. has stated that it concurs generally in the Commissioners' expressed views. Yet, on the very first occasion, it strongly supports a radical departure from the policy deliberately selected by the Commissioners, and offers the strongest opposition to proposals entirely consistent with these views. It goes so far as to threaten the Commissioners that if they decide against the Council's views, it will gravely consider withdrawing the L.C.C. support and assistance from the constitution of a joint electricity authority, and throw the tormented affair of the future electricity supply for London back into the melting pot.

In short, if London electricity reorganisation is not to be carried out as the L.C.C. dictates, the people of London may wait until the Greek Kalends for the cheap and abundant supply which they sorely need.

The L.C.C. in this matter is labouring under an obsession which obscures from it the real public interest, the only permanent and supreme interest—that of the consumer.

It is perhaps a phase of the municipal *v.* company controversy which has damaged electrical enterprise, and, of course, the consumer, for nearly forty years, and which might have been allowed to die after 1919. It is of immensely greater importance to the consumer, and that means to the whole community, that there shall be good service, than that the service shall be given by one or another kind of undertaker. Council or company, Tom, Dick, or Harry, the community interest is in good service. Names don't count.

Spain's Tariff Wall.

Conflicting reports have been current regarding the outcome of the tariff dispute between France and Spain, and the actual effect of the settlement, if ratified. In Paris those who negotiated the arrangement claim that it is based on the principle of reciprocity. Spanish manufacturers urge that it substantially weakens the protection that is essential to their prosperity. Indeed, it was believed in Barcelona that Catalan industrialists would prove sufficiently importunate to prevent the Government at Madrid from signing the agreement. A section of the Press regards the pact as the last straw, which will break the back of British trade in Spain, because, after many months of almost prohibitive duties on United Kingdom goods, Britain has, it is said, now lost to France the position of most-favoured nation. Thus far we have been talking of reports. Now let us state the facts. The situation is of special interest to our readers because amongst the concessions granted to France is a substantial reduction in the import duty on electric motors. The truth is that at present our exporters of electric motors and of the other goods covered by the new Franco-Spanish convention—which has now actually been signed—are in a better position than they have been for some time, for the simple reason that a most-favoured-nation arrangement still exists between this country and Spain, and consequently we benefit by all reductions in tariff rates which are granted to any other country. That is the position at the moment of writing. A change may have taken place by the time these lines appear, for a new agreement has been under discussion for many months. This may possibly annul the most-favoured-nation principle. British traders with Spain are asking why there should be so much delay in concluding arrangements by which their business may be placed on a definite basis, whilst France has obtained a settlement and, it is rumoured, a convention with Germany is almost concluded. The reason may lie in the fact that Britain has carried on no tariff war with Spain, as France and Germany have, because we have no effective weapons with which to wage it.

Domestic Appliances and the Cost of Electricity.

It is both interesting and useful to obtain expressions of opinion from the public in matters mutually affecting them and the electrical industry. The reasons for the comparative neglect of domestic electrical appliances, in spite of their admitted advantages, are generally well known to the industry, but the subject has recently been ventilated in the columns of *The Times*, and a brief review of the correspondence may be beneficial. The matter was opened by a letter regretting that the British housewife should be so unenterprising as not to adopt electrical labour-saving devices in her home. This drew a number of replies in which the reasons for her attitude were given, including the following: the initial cost of these appliances; the lack of hire-purchase systems; insufficient electrical education by exhibitions, &c.; the complication of electricity tariffs; and, of course, the high price of electricity and electrical installations. Subsequent letters centred around the last points. Two or three correspondents expressed their inability to understand why "power" charges should be lower than those for lighting, and this shows that there is ample scope for explanations similar to that recently issued by the Woking Electric Supply Co. (mentioned in our issue of July 7th), which, while dealing with the necessity for the minimum charge, could easily be extended to cover the other question. The separate circuits for lighting and power were objected to, and one or two correspondents favoured the adoption of a "two-part" system based on rateable value or floor area, which would also eliminate the tariff complications which the householder often finds so difficult to understand. Yet another letter advocated the remission of the burden of installation expense which the consumer has to bear.

All these questions, we believe, are receiving attention,

but there is still a need for a more general recognition of the disability under which electricity labours while these matters are allowed to go unremedied. To attempt to draw up a uniform scheme is no doubt out of the question owing to the lack of uniformity in local conditions. Nevertheless we believe that each undertaking might "do its bit" by instituting at least one of the following necessary reforms:—A two-part tariff; "free" wiring, *i.e.*, gradual repayment of cost by the consumer; a comprehensive hire or hire-purchase system (in conjunction, perhaps, with local contractors); a more generous extension of mains; and a scheme for the education of consumers or prospective consumers. To urge the reduction of the price of energy would be superfluous, as this is one of the supply engineer's objects in life.

Labour Representation on J.E.A.'s.

We have previously commented on the claim of Labour to be represented on the Joint Electricity Authorities, and we took the view that as the electricity supply industry was so comprehensively organised industrially under the Whitley Councils there was no call for representation on the J.E.A.'s. However, in the Electricity (Supply) Bill there has now been introduced a clause which makes such representation permissible. The original amendment put forward was that "organisations" representing persons employed in the industry should be entitled to seats on the J.E.A.'s, but this amendment was withdrawn and a new clause agreed. This new clause provides that the "interests" (referred to in the 1919 Act) which may be represented on the Joint Electricity Authorities shall be read as "including the persons employed in connection with the supply of electricity." The new clause, as we have mentioned, is entirely permissive, and representation is left as a matter which may or may not be included in a scheme for a J.E.A. Up to the present, none of the schemes has included such representation, and in view of the fact that the National Industrial Council for the industry is the supreme and quasi-legal body for dealing with all industrial questions, there would seem to be no occasion for making any alteration in the present policy. Moreover, a further anomaly would be introduced by such representation of the Trade Unions, since the representation must be of the persons in the area employed in the industry and not in any way representing "organisations," that is, Trade Unions. Altogether the only proper way to give representation seems to be by providing a seat for a member of the particular District Industrial Council for the area concerned, who would act on the Joint Electricity Authority as a kind of liaison officer between the two bodies. This would also cover another provision of the same new clause in the Bill which states that the scheme may lay down the conditions of employment of persons employed by the J.E.A. since this matter is again, of course, the particular domain of the District Industrial Council. Representation of this kind might the more readily be given since the various industrial districts under the Whitley scheme roughly coincide with the districts delimited by the Electricity Commissioners for Joint Electricity Authorities (or equivalent bodies).

Central European Reconstruction.

That a certain degree of restoration has been effected in Central Europe is apparent from three official reports that have recently been issued by the Department of Overseas Trade. They deal with countries where difficulties due to the low rate of exchange for their currency have been a great obstacle to foreign trade, at any rate with Britain, the United States and Switzerland.

Referring first to Rumania, a country whose agricultural resources are such that a succession of two or three good harvests would mean a substantial recovery in purchasing power, it is satisfactory to know that the Government is actively endeavouring to place its existing indebtedness on a satisfactory basis. At the time Mr. Adams, the Commercial Secretary at Bukarest, revised his report (April, 1922), no reason could be seen for any rapid rise in the value of the leu in Rumania or in its international quotation. Prospects may have improved slightly since, but not materially. He advocated the removal of the restrictions upon the petroleum industry and the freeing of export trade. In the latter connection, something has since been done, *i.e.*, the lifting of the embargo on exports of certain cereals.

With regard to Hungary, foreign trade, hampered though it has been by the difficulties of exchange and restrictions in the form of import and export licences, has, according to the Commercial Secretary at Budapest, shown a distinct improvement on the previous year. He observes that British business men have shown exceptional keenness to take advantage of every opportunity; they have been at pains to find out what customers require, and have done everything possible to meet their wishes. There are signs that Hungarian industries, despite serious setbacks, have turned the corner, and the prospects for the future are encouraging.

In Poland much progress has taken place. Poland's natural assets have been considerably increased recently by the incorporation of a part of Upper Silesia, with its rich mining, metallurgical, engineering and chemical industries. Sound economic measures have been introduced by the Government, and these, coupled with the natural benefits of a good harvest, have improved the economic position. The Commercial Secretary of Warsaw points out that the process of consolidation has begun, and the country has given proofs of the capacity to become self-supporting. All these developments give hope that more business such as the recent contract for an electrically-driven cotton mill, will before long be placed in this country.

The Eastern Telegraph Jubilee.

The manner in which the Eastern Associated Telegraph Companies signalised the fiftieth anniversary of their incorporation on Monday last was worthy of the occasion and of the huge organisation which owns 130,000 miles of submarine cable, representing a capital of nearly 25 millions sterling, and comprising four-tenths of the cable system of the world. The banquet and fête which were held at the Royal Botanic Gardens were planned on a scale of the most lavish hospitality, and the entertainments provided were as diversified as they were excellent, whilst the illuminations in the gardens, employing many thousands of "lighting points," were extremely effective, and the display of fireworks was not merely brilliant but even thrilling—all London heard the heavy reports, and it is said that many people thought an air raid was in progress. To crown all, the weather was all that could be wished. Congratulations are due to the Eastern Companies, not only in respect of the completion of their first half-century as an incorporated body, but also on their admirably successful celebration of that noteworthy event.

It will not be forgotten that the electrical industry was founded upon telegraphy, which, 50 years ago, was in fact the industry itself; and the manufacture of submarine cables, which was begun in 1850 in this country alone, provided the experience which rendered England pre-eminent in the manufacture of insulated cables for electric lighting and power, a position which she still retains. The spirited article by Mr. Roland Belfort, which is concluded in this issue, briefly reviews the romantic history of submarine telegraphy, and recalls the names of some of the great telegraph pioneers whose work has so largely contributed to the establishment and maintenance of the greatest Empire that the world has ever seen.

This is a year of jubilees. The Society of Telegraph Engineers, now the Institution of Electrical Engineers, has already most fittingly commemorated its first meeting, which was held in 1872. It will shortly be the privilege of this journal, which was established in November of that year, likewise to celebrate its jubilee, in its own way. D

SOME PRODUCTS OF THE ELECTRIC CONSTRUCTION CO., LTD.

AMONGST the works thrown open to members of the I.M.E.A. at the recent Convention was that of the Electric Construction Co., Ltd., of Wolverhampton. As we mentioned in connection with the Convention, this company represents one of the earliest electrical manufacturing concerns, deriving its origin from the firm of Elwell-Parker, Ltd., which was established in 1880. It is significant of the youth of the electrical industry that a pioneer company such as this should still count only 42 years to its age—amongst its employés there are some whose service dates from the first day that the works opened its doors, and who are not yet old men. Since that day extraordinary progress has been made in every branch of the industry, and the "E.C.C." has borne its share in the onward march of enterprise and invention; it can look back upon great engineering achievements which have made history, and to-day, as though endowed with perpetual youth, it retains its place in the front rank of British electrical firms, relying only upon its own strength, and looking confidently to the future prosperity of the electrical industry.

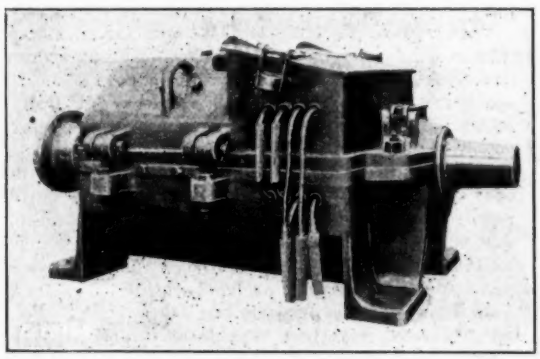

FIG. 1.—E.C.C. 60-H.P. STEEL-WORKS MOTOR.

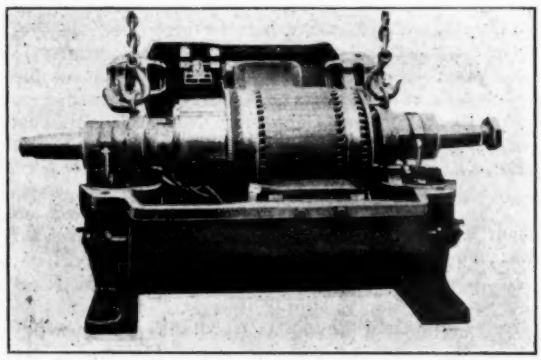

FIG. 2.—REMOVING ARMATURE AND BEARINGS OF MOTOR.

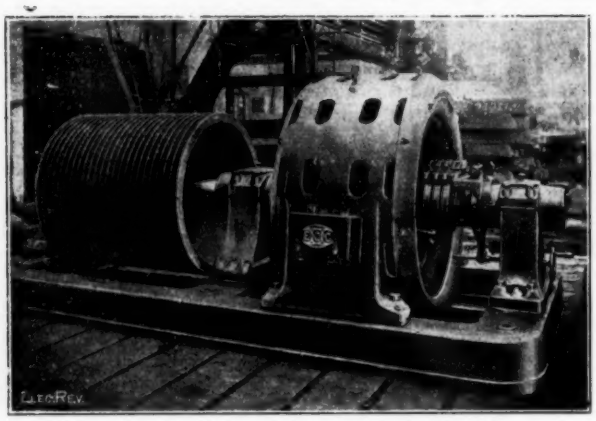

FIG. 3.—E.C.C. 750-H.P. THREE-PHASE MOTOR FOR ROPE DRIVING.

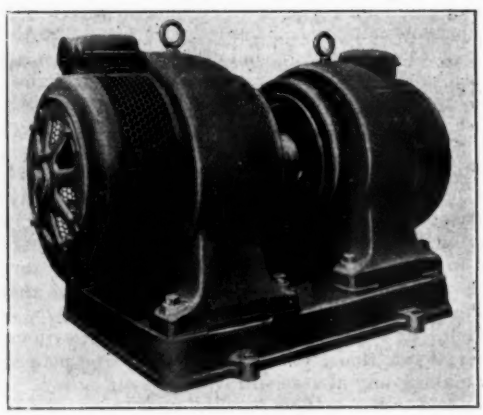

FIG. 4.—E.C.C. TYPE G.M. D.C. 30-kW MOTOR-GENERATOR.

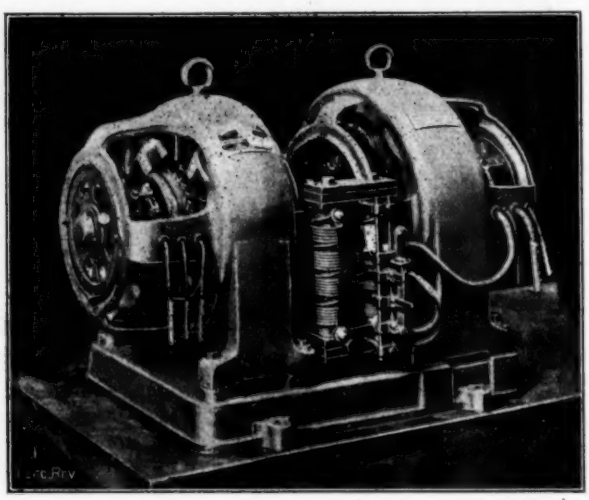

FIG. 5.—E.C.C. WELDING SET.

As becomes a concern with so long and honourable a record, the relations between the management and the workpeople are exceptionally cordial, and the interests of the latter are the special care of the former. During the recent labour troubles, the Electric Construction Company endeavoured to provide employment for as many of its workers as possible, with a large measure of success, and on the occasion of our visit to the Bushbury works during the Convention we saw a variety of machines and apparatus in course of manufacture, ranging from wireless telegraphy to steel-works machinery. The workshops are well equipped with up-to-date machine tools, and a noticeable feature was the extreme care bestowed upon the preparation and application of the insulating materials, as well as the thoroughness with which the processes of impregnation and baking of windings were carried out.

A batch of 60-h.p. E.C.C. motors for driving live-rolls in one of the mills of the Steel Company of Scotland was recently completed, and one of these is illustrated in figs. 1 and 2. It will be seen that the machine is of very substantial construction, of the totally enclosed 4-pole, d.c. type, and provided with a double-ended shaft.

Accessibility of parts is a special feature of the design, the ease with which the armature and bearings can be removed being obvious from the illustration, fig. 2.

Fig. 3 shows an a.c. motor for a Lancashire cotton mill; this machine is rated at 750 h.p., at 500 r.p.m., and is built for 440 volts, 50 cycles, three-phase, with a grooved pulley for driving by ropes.

A new standard type of d.c. machine is illustrated in fig. 4, which shows a 30-kW motor-generator, transforming from 600 to 220 volts; and fig. 5 is a view of a standard motor-generator set of which many examples have been supplied to the Equipment and Engineering Co., Ltd., for arc-welding work, the generator of this machine having a special differential compound winding, and an inductive diverter for adjusting the compounding to suit varying welding currents from 50 to 250 amperes, at 35 volts (the diverter will be seen between the yokes).

A specially interesting motor alternator is shown in fig. 6; this is destined for the Manchester Corporation, for use in connection with cable testing at the Barton power station. The alternator is designed for an output of 2,600 kVA at 6,600 volts, 50 cycles, single-phase, with a leading power factor ranging from zero to 0.02; it is driven by a 440-V motor of 250 h.p. at 500 r.p.m., and is provided with its own exciter. Figs. 7 and 8 show respectively the stator and rotor of this set.

Several single-phase high-frequency motor-alternator sets for use in connection with wireless installations, generating at a frequency of from 300 to 500 cycles per second, were also seen in the works.

Mr. Will M. Furniss is the manager, in succession to the late Mr. Builoch, and we tender our thanks to him for the courtesies offered us on the occasion of our visit, as well as to the chief engineer, Mr. Tonkinson, for photographs and particulars of the apparatus described in this article.

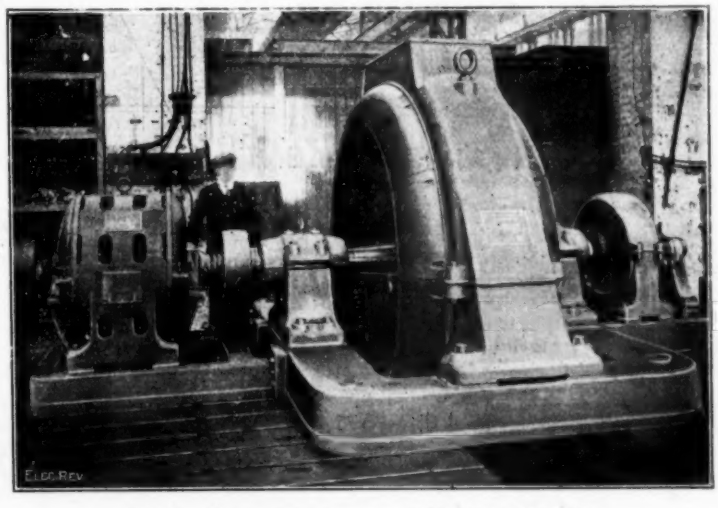

FIG. 6.—MOTOR-ALTERNATOR OF 2,600 kVA at 6,600 V.

FIG. 7.—STATOR OF 2,600-kVA ALTERNATOR.

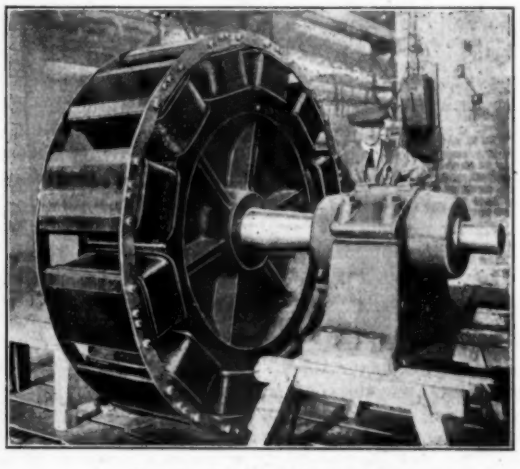

FIG. 8.—ROTOR OF ALTERNATOR.

Photograph Drying Machine.—Two young London engineers, both keen photographers, have succeeded in producing a machine which dries a photographic print in four minutes. The drying is done by means of an electrically-heated absorbent "blanket," and at the end of four minutes the print is automatically ejected, perfectly dry and uncurled, into a tray. While it takes four minutes to dry a single print the machine can take a batch at a time. By being continually "fed" more than 3,000 prints an hour can be perfectly dried, says the *Evening News*.

THE GLASGOW TRAMWAYS.

ANNUAL REPORT.

THE annual report of the Corporation tramways for the year ended May 31st, 1922, contains a mass of statistics relative to every phase of working, but from this emerges the fact that the year's operations proved eminently satisfactory, enabling the Committee not only to extinguish the balance of the 1919-20 deficit, but also to carry forward a sum of £149,880.

The revenue of £2,350,753 was slightly lower than that of the previous year (£2,392,854), but the working expenses decreased in greater proportion, the figures for the two years being £1,937,066 and £1,804,652 respectively. The gross profit was thus £546,101, as against £455,788 in 1920-21. The principal divisions of the expenditure side of the revenue account all showed decreases. Traffic expenses fell from £1,018,501 to £1,007,318; general expenses from £254,573 to £218,820; general repairs and maintenance from £461,999 to £413,521; and power expenses from £199,517 to £162,761. To the balance carried to the net revenue account was added £3,541, interest, making a total of £549,624. Against this were charged: Payment to Paisley District Tramways Co., Ltd., for use of lines, £15,635; capital charges, &c., £71,933; and contribution to depreciation and permanent way renewals fund, £309,350; leaving a net surplus of £152,724, comparing with £105,796 in the previous year. Part of the surplus (£2,735) was utilised to pay off the remainder of the 1919-20 deficit, and the rest was appropriated to the "Common Good." A balance of £466,472 remains at the credit of the depreciation and permanent way renewals fund. The capital account records a capital expenditure during the year of £591,285, making the grand total expended on the system £4,646,177. The principal items of the year's expenditure were:—Electrical equipment of lines, £91,290; buildings and fixtures, £118,864; and power and sub-station plant, £126,749.

The traffic returns show a decrease in the number of passengers carried from 447,601,811 to 431,372,473, but an increase in the number of car-miles run from 26,902,874 to 27,024,529; the energy used per car-mile remained the same—1.6 kWh. The number of double-track miles which the Corporation owns, or over which it has running powers, was practically 100 miles at the end of the year. The track was renewed at various places over a total length of 25¼ miles, and the extension from Netherlee to Clarkston was opened in August last. Work was commenced on extensions in the following districts:—Provanmill, Milngavie, Millerston, Coatbridge, London Road, and from Anniesland to Dumbarton Road. It is expected that the new depôt at Parkhead will be completed during the present summer; the cars now housed at Whitevale will then be transferred to Parkhead. Whitevale is to be handed over to the Electricity Department.

The output of the Pinkston station during 1921-22 was 46,397,754 kWh, of which 1,245,651 was supplied to the Electricity Department. The maximum load was 13,500 kW, and the load factor 39.23 per cent.

An analysis of the revenue shows that about a third of the total was derived from 1½d. fares, and a slightly lower amount from 1d. fares.

The report contains numerous diagrams showing such statistics as the proportion of operating expenses to receipts; the proportion of wages to receipts; average fare paid; number of passengers carried, &c., from the inception of the undertaking. Five pages are devoted to a statement of the receipts for each week of the system's existence. The highest weekly revenue in 1894-95 was £5,918; in 1921-22 the figure was £50,225.

AN ARRANGEMENT FOR D.C. METER TESTING.

By J. B. WILLINGHAM.

RECENT developments in manufacturing circles resulting in the increased efficiency of incandescent lamps and sundry domestic appliances, together with the reduced prices of these commodities, coupled with less expensive and simpler wiring methods, are inducing a great number of small householders and shopkeepers to take advantage of the many benefits to be derived from the use of electricity. In consequence, the supply engineer is called upon to cater in many cases for a class of consumer whose load factor is comparatively low. This specially applies to residential areas, housing schemes, and poorer class dwellings where the B.O.T. units sold are small compared with the total connections to the distributors. In view of the fact that in many districts the number of consumers coming under this category is steadily increasing, the question of periodically checking the accuracy of the meters installed becomes one of great importance to the undertaking concerned. Although of late the "current limiter" has found much favour in some quarters (a system whereby each consumer is charged a "contract" rate over a given period, corresponding to his maximum demand), it is doubtful whether this instrument will replace the supply meter to any great extent in the near future. In any case, it is practically certain that with the majority of undertakings the number of small meters sent out each year is going up by leaps and bounds, and measures have to be considered with a view to adopting some method whereby they may be tested and adjusted from time to time.

Hitherto, perhaps, it has only been considered necessary to replace obviously faulty meters as they are reported by the meter reader; this, however, will give no indication as to the condition of meters which *appear* to be working all right, but which may, if subjected to tests, show considerable errors in registration. The conditions imposed upon the average meter are usually pretty severe, and in order to arrive at the true state of affairs with apparatus of this description, it is necessary to employ reliable instruments and accessories, and a wide range of current values should be available for carrying out the work.

The use of a standard meter coupled in series with the meters to be tested usually entails a great waste of time, as it is essential that tests be taken at different loads corresponding to, say, ¼, ½, and full load of the meters under test; then again, unless the standard is *itself* periodically checked for accuracy, errors will be bound to creep in.

It will, generally speaking, be found much more satisfactory to use standard *indicating* instruments, and when they are employed for no other purpose than checking meters, and are carefully handled, they will be found to retain their accuracy over long periods if of good design. A ready means of easily adjusting the current value is required, and the test room should be well lighted and as free from dust or fumes as possible. In taking short-time tests on motor meters, it is imperative that a reliable stop watch be used; some stop watches have starting and stopping errors which may seriously affect the results of the tests. Any instrument which leaves a shadow of doubt as to its accuracy should be at once discarded. A little consideration will show that a small error in the watch, for instance, may materially affect the tests. Where the test room is in close proximity to a battery room, little trouble should be experienced in obtaining any desired ampereage, together with easy means of controlling and maintaining the

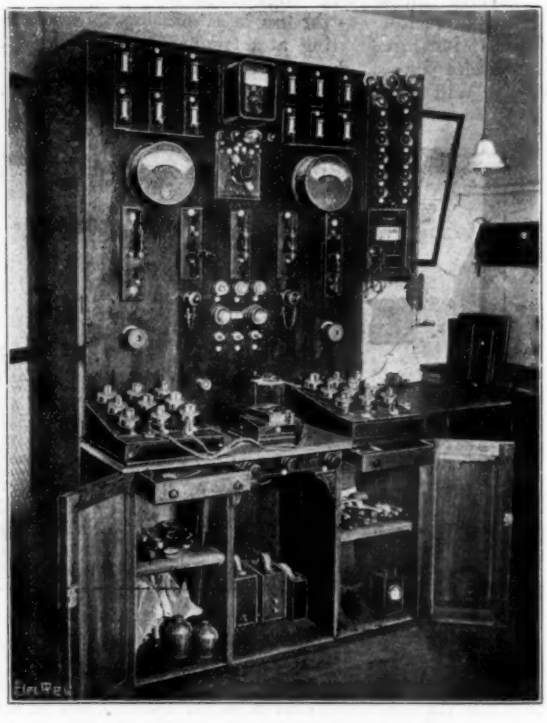

FIG. 1.—TESTING BOARD FOR D.C. METERS.

magnitude of the current constant for any load over a given time, this being usually effected by utilising two or more of the "end" cells and inserting a liquid, or other suitable variable resistance in series with the standard ammeter and meters to be tested; this, of course, applies to meters of the ampere-hour type (in testing energy, or what are better known as watt-hour, meters the pressure circuit should be disconnected from the terminals and separately excited by a source of e.m.f. from the remainder of the battery, or from the mains direct, the pressure employed being maintained equal to that marked on the name plate of the meter undergoing test).

Where, however, the test room is situated right away from the power house and battery in another part of the town, the fixing up of apparatus for carrying out these tests calls for more careful consideration.

In contemplating the design of a suitable arrangement under such circumstances, local conditions will, of course, have to be considered, and if the accommodation is available, the question of a motor-generator or a small battery of cells might be entertained, but it is advisable to keep *both* out of the test room proper, the former on account of the noise, while in the latter case the gases given off during charging are detrimental to the instruments and meters, and are certainly objectionable to the tester.

The following is a brief description of a testing board constructed to operate from the service mains direct, the supply being 3-wire, 250-500 volts. The three wires are brought to three cartridge-type fuses and thence to three

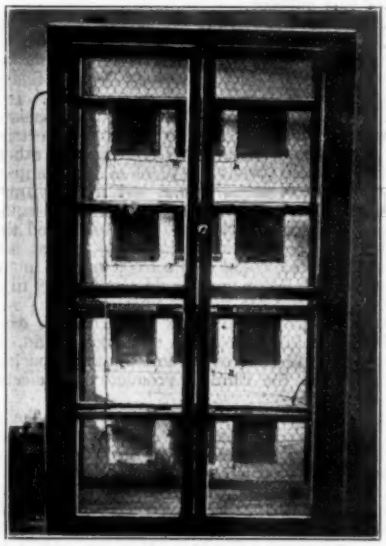

Fig. 2.—Resistances for d.c. Meter Testing.

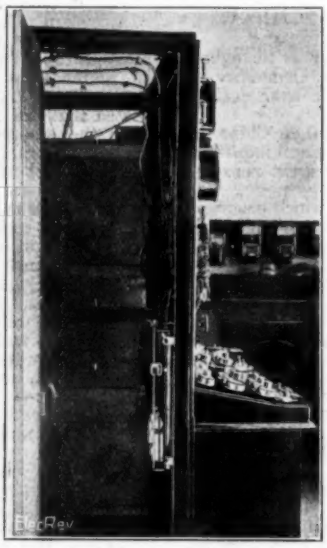

Fig. 3.—Back of Testing Board.

single-pole knife switches mounted on the control panel (shown in fig. 1), current being taken for test purposes between the positive and neutral conductors up to about 40 amps. When arrangements are made to load the negative side in order not to seriously upset the balance of the system, suitable resistances to dissipate the energy are shown mounted in their frame in fig. 2; these consist of a series of "nets" made up of a special alloy of resistance wire interwoven with asbestos. The heat given off when loaded is fairly considerable, but fortunately a place was found for them outside the test room; the conductors led out are also asbestos covered where they enter the frame work. There are in all 12 units mounted in the frame, each arranged to pass a definite current at 250 volts, as follows: six to pass 10 amperes, two to pass 5 amperes, two to pass 3 amperes, and two to pass 2 amperes. The two 2-ampere units are each connected in series to a variable sliding rheostat having a total resistance of 3,000 ohms; these are of the back-of-board pattern, their respective control handles being shown on either side of the panel (fig. 1) immediately under the single pole throw-over switches. It will be seen that wide variations of current values may be obtained by switching in any or all of the resistance units as a "rough" load and then making final adjustments by means of the two regulators. For loads of 2 amperes and under, the rheostats are, of course, used alone, the current passing in the circuit with all resistance in equals about .08 amp. in either regulator, this being considered quite low enough for all practical purposes. A reference to fig. 3, showing the back of the board, will give an idea of the design of the regulators, and also the accessibility to the connections of the whole outfit. It will further be noticed that the framework is covered with a fairly fine mesh wire netting, and that on one side a hinged door (also wire netted) is attached. It may be of interest to remark that the board was designed, erected and the accessories and switchgear assembled on site, the overall dimensions being 7 ft. 2 in. high, 4 ft. wide by 4 ft. 6 in. deep, the woodwork consisting of well-seasoned whitewood stained and varnished. The scheme permits of two entirely independent tests being carried out on separate test benches at the same time; this is effected by manipulating the two throw-over switches referred to above, the switchboard being divided, as it were, into two separate groups, each with its own selector switches and regulator. The position of the switches, as shown in the figure (that is, one in the upper contact and the other in the lower contact), illustrates this method; each bench has now a range of 0.8 to 45 amps. by throwing both switches in the one direction (we will assume into the top contacts), the two groups are combined, that is, the one bench has now a range of 0.08-90 amperes, the two regulators are, of course, also combined; this has the advantage in that the tester has a much greater facility for steadying the current on the higher loads just when it is most needed. By reversing the two switches into the lower contacts, the other bench is served by the same range of current; thus meters of a fairly large capacity may be dealt with at either bench, a pair of terminals being provided on both for making the necessary connections to the meters. Three terminals for obtaining the desired pressure when carrying out tests on watt-hour meters are also situated within easy reach, but are protected by separate switches and fuses mounted on the board, and a red or blue pilot lamp within view of the operator indicates whether either or both "sides" of the system are "alive" to the terminals. The utility in the method of being able to independently "divide" the controls will be apparent, as it enables, for instance, a row of slot meters to "run out" on one bench or a group of meters on "dial test" to be connected up and left to look after themselves while the tester confines himself to ordinary work on the remaining bench. It will further be seen by the arrangement of terminals on the selector switch panels that two standard instruments may be inserted, thus enabling two testers to work at one time, each independently of the other. The pilot lamp board shown on the right indicates by colours the load on each group, so that there is little chance of one man interfering with the other during such tests. A voltmeter (employed for testing watt-hour meters) controlled by a three-way switch giving the pressure on either side or across the "outers," a low reading ammeter for arriving at the "starting" current of the meters under test, and an integrating watt-hour meter for measuring the energy consumed in the test room completes for the most part the general lay-out. The standard ammeter, it will be observed, is fitted with a magnifying glass to render a clearer vision of the scale divisions; a "striplite" lamp is also provided, but is not shown in the picture.

The great disadvantage of such a scheme is, of course, the waste of energy involved, but this is not so pronounced as one would at first imagine. The records show that on an average taken over a twelvemonth, 0.35 kWh is consumed for each meter tested, the majority of the meters being small service types, ranging from 2½ amps. to 20 amps. capacity.

It was considered advisable to separately fuse each resistance unit on account of the main fuses having to be loaded fairly high. Small tools and instruments are kept in the cupboards and drawers, which are fitted with lock and key, and the whole board makes a compact arrangement, and has given every satisfaction in prac-

tice. The reader no doubt will be able to see many modifications which could be effected to suit any particular range or purpose; for instance, the load might be made up of incandescent lamps instead of resistances, although these are usually objectionable on account of the glare. The success in working such a system depends to a great extent on the steadiness of the applied pressure, but in any case it would be found necessary to employ an observer to watch the instruments in order to make sure that the load was kept constant during tests.

In conclusion, the writer would like to add that thanks are due to Mr. J. E. Stewart, M.I.C.E., engineer and manager, the Llanelly and District Electric Lighting and Traction Co., Ltd., for kindly consenting to the publication of the above prints and particulars.

ELECTRICAL ENTERPRISE IN CHINA.

Mr. J. W. Ross, Canadian Trade Commissioner at Shanghai, recently sent to the Department of Trade and Commerce at Ottawa the following report, dated April 10th last, dealing with electrical development in China :—

When one considers the backward condition of China in some directions, the slow development of modern industrial enterprises throughout the country, and the great need for better transportation facilities and other improvements, it is somewhat surprising to observe the manner in which electrical development and installation has been accepted by the Chinese people, and how quickly they have adopted the electric current in its various methods of application to their different needs. Shanghai, of course, set the fashion many years ago, and all provincial capitals and many of the large cities have quickly followed suit, so that wherever one travels in China to-day in the towns and cities of importance, electric light installations will be found, but it is not only for lighting purposes that the Chinese make use of the electric current, for many small industries in the different towns employ the current for power; this applies particularly to rice mills, silk filatures, small machine shops, and other small industries. Nearly all the electric light plants throughout China are owned by stock companies, and rarely by municipalities. In Shanghai, Tientsin, and Hankow as well as Hong-Kong, the electric light plants belong to the municipalities, but in purely Chinese cities they are owned by stock companies. In all the distinctively Chinese cities along the Yangtsze river, electrical plants have been installed, even as far west as Chunking, the capital of Szechuen Province, and in addition many private enterprises, such as cotton mills and flour mills, have installed small lighting plants for their own use in connection with their mills. Such installations are to be found at Wusieh, Hankow, Tsinan, Tientsin, Tsingtao, Dairen, and at different other points, and a great number in Shanghai. With the continued increase in the number of installations and the general advance in industrial enterprise in different parts of the country, it was to be expected that imports of electrical material into the different ports would show a general increase year by year, and this has been the case. The figures of imports for the past six years, given in Haikwan taels, show clearly the growth of this business as follows: 1914, 2,114,400; 1916, 3,568,700; 1917, 4,378,400; 1918, 4,307,550; 1919, 5,170,100; and 1920, 6,515,000 Haikwan taels.

Chinese Customs returns go to show that many countries contribute in greater or less extent in furnishing China's demand for electrical material, but the chief sources of supply for the past six years have been Great Britain, United States, and Japan. Formerly Germany had a large share of this trade, but she was, of course, shut out during the war. In 1920, however, imports from that country were valued at Hk. tls. 98,500, showing that Germany is again coming back, and as this is one of the lines of manufacture in which that country specialises, increased imports into China from that source in future years may be looked for; in fact, many evidences point to a very active participation by Germany in China's coming requirements of electrical equipment.

The range of imports of electrical equipment, although not specially classified, comprises everything required in complete installations and in the distribution of the current.

All the well-known British, United States, and Japanese manufacturers are represented in China, each of them having their own agents or agencies, and large stocks of standard equipment, as well as small dynamos and motors, are carried, and are constantly obtainable. The demand is large and the market active and expanding; at the same time, it is a market that cannot be exploited through correspondence; to write letters and send out catalogues in the hope of selling electrical goods to China would be a sheer waste of time and postage. On the other hand, an active salesman carrying samples and having special lines to offer could no doubt make sales, for almost anything can be sold in China when personally represented and samples are shown, but the Chinese will not pay any attention to letters or catalogues.

An interesting fact in the development of the use of electricity in China is the number of Chinese who have a working knowledge of electrical mechanics and the general work pertaining to the distribution of the current, and the usual repairs of equipment, wiring of buildings, &c.; in fact, it is the Chinese who do all the work, their direction and organisation being under the management of a foreign engineer. Small repairs, such as the installation of fans and bells,, the extension of existing plant and similar work, can always be carried out by a Chinese contractor at a much lower cost than would need to be paid to the large foreign engineering firms—consequently they do most of this class of work.

As yet no hydro-electric generating plants have been established in China, and it is not likely that any will be for many years, for the reason that there are very few sources of water-power supply in the country. Without doubt the Upper Yangtsze river is capable of furnishing many thousand horse-power, but as this source is far away from the manufacturing and industrial centres, there would be little demand for the power even if it were available, but in the vicinity of the seaboard and the present manufacturing cities there is no water power available for development, consequently steam is the only power employed, but fortunately there is an abundance of coal in China for this purpose.

A concern to be called the Electrical Appliances Manufacturing Company of China, has recently been formed, consisting of Chinese capital with German co-operation. This organisation has purchased a large tract of land at Soochow, on the Shanghai-Nanking Railway, fifty-three miles from Shanghai. It is stated that the Hugo Stinnes China Company are associated with the enterprise and that they control certain electrical patents, those of the Siemens-Schuckert Company and others. It is not very clear at present what the plans of this company are, or what they propose to manufacture, but it is presumed that they intend to produce many of the small classes of equipment, all of which are now imported. It is understood that their object in erecting these works at Soochow is that land suitable for such large works would cost a huge sum of money at Shanghai. Taxes at the latter port would also be very high. Soochow is not badly placed for factory purposes; it is on a direct line of railway, and has also water connection by canal to Shanghai and ocean shipping. On the other hand, all skilled labour would need to be brought in from other ports.

The report, referring to the Chinese production of electric lamps, says :—

"Three years ago the General Edison Co. of China began the manufacture of electric light lamps or bulbs. They have been able to train Chinese workmen, and for selected men they pay 80 cents to Mex. $1 (40 to 50 cents Canadian currency) for a ten hour day. Such workmen will produce 1,700 to 2,000 bulbs per day, while expert American workmen for the same class of work receive as high as $10 gold for an eight-hour day, and turn out about 1,200 to 1,500 bulbs. After the bulbs are made they are passed to lamp makers, who receive 40 cents Mexican per day (20 cents Canadian), whereas an American workman receives $4.10 gold per day for the same work. This is not all, for the Chinese-made lamp when completed is a better lamp than the American lamp. The latter has a burning power of 1,000 hours, while the Chinese lamp has a burning capacity of from 1,200 to 1,500 hours. This is an example of the skill of Chinese workmen and the success of Chinese industries when they are operated under systematic foreign management. For the first time in history electric lamps, as above described, were successfully exported to the United States in 1921, to the value of $35,000 (United States currency), and this in the face of a very high import tariff."

From another source we have received the following review of the growth of interest in electrical undertakings (lighting, tramways, and telephones) in Shantung :—In 1894 an electric light company was established at Tsinan, called the Tsinan Electric Light Co. The annual profit is estimated to reach $100,000, and the company is now installed in a new building which is equipped with machinery of the latest type. Next in importance to the Tsinan Electric Light Co. is the Tsining Electric Light Co., which was established in 1918 with a capital of $80,000. The amount of capital has been gradually increased to $200,000. The Electric Light Co. at Fangtze was started by certain Japanese capitalists, but in view of the opposition of the local inhabitants and the financial losses sustained by the company through poor business, it was transferred to a Chinese concern and refloated with a capital of $30,000 in 1920. In view of its contiguity to Weihsien, the company has planned to extend its lighting system so as to supply both cities with electricity. Official permission has been obtained, and the company will shortly move its head office to Weihsien. A new power station has been erected there and a new plant is to be installed. The Electric Light Co. at Tenhsien was started last year with a capital of $60,000. In a few months the number of lamps supplied to the district was increased from 1,000 to 2,000, and by the end of the year the company had declared a dividend of 15 per cent. The Lung Hwang Electric Light Co. will supply electricity to Lungkow and Hwanghsien. Lungkow, a port open to foreign trade, has been growing in importance as a commercial centre since the completion of the work for harbour improvement, while Hwanghsien lies on the Chefoo-Weihsien Railway, a zone rich in natural resources. The

building for the company is being erected at Lungkow and a new plant has been ordered. It is expected that the company will be opened for business in the autumn.

In 1920 Ma Tan-ming planned the construction of a system of tramways in Tsinan with a capital of $1,000,000. Applications were made to the Government and the local officials for permission, but sanction was not given till the winter of 1921. Three lines will be built in different parts of the city. The first is to run from Pulimen to Lokow, the second from Pulimen to Yuanchien, and the third line is to pass through the business section outside the city.

The telephone company at Tsinan was started under the auspices of the local officials, but as a result of inefficient management the company was more than once threatened with financial ruin. Unable to meet its financial obligations to a certain foreign firm, the assets of the company were transferred to a group of private persons. Under the good management of private capitalists, the financial position of the company improved considerably, and the dividends went up to 50 per cent. In view of this progress the capital, which had originally been fixed at $100,000, was raised to $700,000. A set of new telephone apparatus was installed in place of the old one, which had been found inadequate to meet the ever-increasing demand of the public. The company recently established three new exchanges at Tsinin, Poshan, and Chowchun respectively, and a new building for the premises of the company is being erected.

NOTES FROM CANADA.

(FROM OUR SPECIAL CORRESPONDENT.)

IT is natural that in a country possessing such immense and widely-distributed water-powers as Canada, the question of railway electrification should be discussed. Some weeks ago this matter was brought up in the House of Commons at Ottawa, and the Minister of Railways indicated that the Board of Management of the National Railways takes great interest in the subject, although present conditions do not favour actually undertaking any scheme of electrification on account of the unduly high cost.

It seems likely, however, that when material and labour costs are down to more reasonable figures the subject will be taken up seriously.

On the discussion of electrification in the House, it was stated that the annual value of the timber lost in forest fires is from 10 to 15 million dollars, and that many of the fires are due to sparks from locomotives, a cause which would be eliminated if the railways were electrified. It is understood that the Canadian Pacific Railway has had electrification under consideration for several years, but that so far it has not been feasible to make an actual start on any section of line.

The Commissioners of the Temiskaming and Northern Ontario Railway, which runs through the mining districts of Northern Ontario, have had the matter of electrification under consideration for several months, as there are various water-powers in the region which would supply ample power for the railway as well as for the mines.

The question of canalising the St. Lawrence River and developing its immense water-power as a joint scheme was reported on some months ago by the International Joint Commission, and since then the matter has been a subject of discussion by both the Canadian and the United States Governments. The latter Government recently asked the former if it would consider the question of entering into a new treaty regarding the permissible diversion of the waters of the international portion of the river, but the Canadian Government replied that under present conditions of high costs it was not considered advisable to go ahead with any scheme. Apparently even the making of a treaty was thought to be premature.

Although this attitude will postpone action, perhaps for a year or more, the matter is sure to be brought up again.

As an offset to the St. Lawrence scheme, a certain element in Canada advocates the Georgian Bay Canal scheme as possessing several advantages, such as the fact that it would be entirely within Canadian territory, immunity from the storm hazards of Lakes Erie and Ontario, and the shorter mileage. The route would be from Georgian Bay on Lake Huron, along the French River through Lake Nipissing, to the Ottawa River, and thence to the St. Lawrence. It is estimated that on the Ottawa and French Rivers about 1,000,000 h.p. could be developed.

In Western Canada the Manitoba Power Co. is engaged in the development of about 170,000 h.p.; the initial plant will consist of two 28,000-h.p. vertical turbines, to which four more will be added later. The working head is 56 ft. The dam will be 750 ft. long, with a maximum height of 70 ft., and the power-house will be 110 ft. wide, 380 ft. long, and 145 ft. high at the highest point. The capacity of each generator will be 21,000 kW, and they will generate at 1,385 r.p.m. three-phase, 60-cycle current at 11,000 volts. The Canadian *Electrical News* states that the machinery cost, including turbines, generators, exciters, thrust bearings, transformers, and switches, will be less than 14 dollars per horse-power.

PARLIAMENTARY NOTES.

(FROM OUR SPECIAL PARLIAMENTARY REPORTER.)

High-Power Wireless Station.—Last week Sir H. BRITTAIN asked the Postmaster-General whether the site for the proposed high-power wireless station had been selected; and by what date it was hoped to have the installation completed?

Mr. KELLAWAY said that a site for the proposed high-power station had been selected provisionally. Its final adoption depended on the result of certain inquiries which were now in progress. It was not possible at this stage to say by what date the installation was likely to be completed.

Rural Telephones.—Mr. FOOT asked the Postmaster-General what progress had been made in respect of the installation of rural telephones since the Post Office estimates were introduced; and to what extent the party-line system had been adopted in such installations?

Mr. KELLAWAY said that as a result of the more liberal terms for rural extensions of the telephone system announced in the estimates debate, support had already been obtained for 13 new exchanges. They would be installed as soon as possible. Canvasses were also in progress at a number of places where there was good prospect of securing adequate support. Since May 1st 662 additional rural party-line telephones had been installed and 151 call offices opened at provisional post offices, chiefly in rural districts.

Electricians in the Navy.—On July 18th, during a debate on the Naval Estimates, Sir C. KINLOCH-COOKE referred to the policy of the Admiralty with regard to Naval electricians. He said that these men had a very reasonable complaint. The stagnation in their class was due to the lack of decision with regard to the future policy, and it was time that the Admiralty made up its mind what was going to be done with the electricians. No retirements were taking place and no promotions were being made to fill the vacancies. The difference of appointment authorised by Form 1 and the Order in Council was very pronounced, and then there was a difference between the positions of the electrician and the engine-room artificer. All these points could be settled by the policy which the Admiralty could lay down at once.

North Metropolitan Electric Power Supply Bill.—On July 19th this Bill was passed by the Unopposed Committee of the House of Commons, and was ordered to be reported for third reading.

Engineering Trade Employés.—On July 19th, Dr. Macnamara, Minister of Labour, informed Capt. W. Benn that the approximate number of workpeople in the engineering trade, including ironfounding, in 1921 was 1,127,000. The weekly full time rates of wages at July, 1914, were: fitters and turners, 38s. 8d.; labourers, 22s. 11d. The usual range of rates at December, 1921, were: fitters and turners, 76s. 9d.; labourers, 59s. 4d.

Electric Light and Films.—On July 17th, during the Committee stage of the Celluloid and Kinematograph Film Bill, which seeks to make better provision for the prevention of fire in premises where raw celluloid or kinematograph film is stored or used, the following proviso was added to Schedule I, Part II:—"If electric light is used, all conductors and apparatus shall be so constructed, installed, protected, worked and maintained to prevent danger. Vacuum-type lamps only shall be used, and shall be in fixed positions and fitted with substantial outer protecting globes."

Royal Assent.—On July 20th, the Royal Assent was given, by Commission, to the following Acts:—South Wales Electrical Power Distribution Company Act, 1922; Torquay Corporation (Electricity) Act, 1922; London County Council (Money) Act, 1922; London County Council (General Powers) Act, 1922; London Electric and City and South London Railway Companies Act, 1922.

Use of Vulcanised Fibre.—On July 24th Mr. Kenyon asked the President of the Board of Trade to what extent vulcanised fibre manufactured in Lancashire was used in Great Britain for electrical purposes; whether he had received representations from electrical apparatus manufacturers as to their dependence on special qualities of this fibre imported from America; and, if so, whether he proposed to take any action upon such representations?

Mr. BALDWIN said that as regarded the first part of the question he had no quantitative information. No representations of the kind referred to in the second part had been made to him, but it was, of course, open to any manufacturers interested to make representations to the Committee.

Receiving Sets for Wireless.—Col. NEWMAN asked the Postmaster-General whether he was aware that the patents for the manufacture of receiving sets for wireless telephony were in Great Britain in the possession of the Marconi Wireless Co. and one or two other smaller firms; and had he been able to consider the value of the monopoly which the Government intended to confer on the Marconi Co. in the proposal which it had recently placed before the House?

Mr. PIKE PEASE (Assistant Postmaster-General) said he was aware that the Marconi Co. and other companies claimed to possess patent rights affecting certain wireless telephone receiving apparatus, but the value of these rights, whatever they might be, would neither be increased nor diminished by the conditions on which he proposed to issue licences.

Wireless Stations.—On July 21st Mr. Kellaway (the Postmaster-General) informed Capt. W. Benn that statutory authority for the issue of licences to establish wireless stations was conferred by the Wireless Telegraph Act, 1904. The conditions on which licences for the proposed broadcasting stations would be issued were at present under consideration.

Black Country Tramways and Light Railways Bill.—This Bill was read a second time in the House of Commons on July 24th.

Electricity (Supply) Bill.—On July 25th, this Bill was read the third time in the House of Commons. It now awaits Royal Assent. During the Report stage a number of new clauses were added, and a fuller report will appear in our next issue.

Ayr Burgh (Electricity) Bill.—This Bill was also read the third time in the House of Commons on July 4th, and now awaits Royal Assent.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electricity in Rhineland.

Many engineers are familiar with electric transmission as applied in Rhineland. I have recently had an opportunity of seeing something of the post-war developments in one part of real Germany, and I am impressed with the grand scale on which they have been planned. Wide avenues have been cut through the forests, along which are erected the lattice iron square-tapered poles carrying the main lines which sweep round vast areas of country with branch lines on wooden "A" poles roping in every description of village, hamlet, or town. Apparently the popular connection in small tenements is two lights and an iron and hot-plate, each controlled by one two-way switch. International price comparisons are misleading, but the fact remains that the rates are so low and the method of charging so popular that the use of electrical energy is becoming universal, and this is enhanced by the initial cost of the appliance being within the range of most working families.

There is a tendency in England against the erection of overhead lines, which is only natural when people see the old-fashioned aerial telegraph wires being dismantled, but it is obvious that it is only by the breaking down of this conservatism that the use of electric power on the scale we all contemplate can be carried out.

I have heard it said on more than one occasion: "No one won the war. The war taught us that the world is one whole. The future is commercial." I am not familiar with the German language, but I have not the slightest hesitation in understanding what is at the back of all this—our younger engineers will one day have to fight; it will be "war," mostly industrial—they have got their warning; it is for us to see that they are equipped in time.

F. S. Paterson, M.I.E.E.

Friedrichrodai, Thür, *July 21st*, 1922.

A Motor Problem.

In reply to the letter of "Safety First, published on July 14th, the excessive voltage rise to which he refers is due to the iron circuit of the motor being entirely unsaturated at the normal voltage. As long as the motor is connected to the supply, a certain proportion of the field ampere-turns, apparently something like half the total in this case, are balanced by the armature ampere-turns. When the supply circuit is opened, the armature ampere-turns cease to exist, and all the field ampere-turns become available for producing flux. As there is no appreciable saturation in any portion of the iron circuit, the flux will now increase to approximately twice its previous value, causing a corresponding increase in voltage.

The remedy is to reduce the cross section of iron in some portion of the magnetic circuit, so that when the flux is at its normal value there is considerable saturation. This is usually most easily accomplished in a salient-pole machine by machining away a portion from the base of the poles, so as to allow "saturation plates" to be fitted between the poles and the spider, the cross section of iron in the plates being adjusted to give the degree of saturation required to keep the voltage-rise down to a reasonable figure. With regard to the danger to insulation, this, of course, depends on the margin of safety allowed by the manufacturers of the apparatus, but it would hardly seem desirable to subject it to a pressure of double that for which it was presumably intended.

Surely no useful purpose can be served by connecting flywheels to a synchronous set? The motor would serve equally well for purposes of power factor correction if run light, or with only a useful load connected, and "Safety First" would be saved the cost of the energy which he now wastes in driving the flywheels.

H. B. Lee.

Sale, Manchester, *July 22nd*, 1922.

Where are the Young Men of the I.E.E.?

I have read with interest and concern—concern for some of the writers, not the Institution—the correspondence in your journal on "Where are the young 'uns"? Youth is impetuous and unreflecting, else the young men would not put the blame for low salaries on their elder brethren who are in the same boat with them. The people to go for are the company directors and town councils, who are the employers and paymasters.

I have had a long acquaintance with members of Council and Territorial Centre Committees, and, without reservation, I say that I have always found them intensely sympathetic to young men. Either your correspondents are unduly thin-skinned or they have been unfortunate enough to come into contact with bounders who have been unduly puffed up with having just managed to scrape into the I.E.E.

I imagine the real reason that so few young men go to the summer visits is that they cannot afford the cost. Also many of the older men—full members—are equally unable to produce the necessary cash, but I have never heard them grouse about it. I agree that it is most regrettable that their money should stand in the way, but instead of blaming their seniors, why do not the young men try to be men and help themselves? I would particularly call their attention to the Continental tours arranged by the National Union of Students. I am quite sure that the energetic and enthusiastic president of the Union—Mr. Ivison S. Macadam, himself a graduate of the I.E.E.—would gladly do all he could to facilitate his brethren taking advantage of his organisation. I enclose descriptive pamphlets relating to the tours organised, but it may be too late to take part in them this year.

Lastly, let me say that my opening words, far from being a sneer, were an expression of sincere opinion. During last year 781 students entered the I.E.E., and I say without hesitation that no man intending to rise in the electrical profession and entering it at the present day can afford not to be in a position to participate in the benefits offered by the Charter, benefits which will wax as time flows on. The I.E.E. can do quite nicely without more students' subscriptions, but it *does* want the loyal support and personal services of every member, high or lowly, of the profession which it represents and fosters.

The case of a one-time student is that of large numbers of men resident in New Zealand, Australia, and other distant parts of the Empire, and it is greatly to be wished that their disability could be removed. The best way is by increasing the number of members in these far lands and by the young men using every endeavour, whether at home or abroad, to take part in the proceedings of the Institution and its branches.

Apologising for the length of this letter.

C. H. Wordingham.

London, S.W.1, *July 24th*, 1922.

The I.E.E. Wiring Rules.

The proposal for electricity supply authorities to enforce wiring rules should be met with satisfaction by engineers and contractors interested in high-class installation work.

Modern electrical developments, and the possibility of greater demands for supply for domestic and other purposes being made by consumers, call for some standardisation of wiring systems.

The rules of the I.E.E. will generally prove to be satisfactory if due consideration is given to the suitability of various wiring systems to the conditions in which it is proposed to install them. I would suggest some form of standardisation on the following lines, which will generally prove satisfactory:—

1. Power.—(*a*) Armoured cable; (*b*) heavy gauge, screwed conduits and inspection fittings, I.E.E. grade cable and iron-clad fittings.

2. Radiators, Cookers, &c.—(*a*) Lead or alloy-covered cables; (*b*) screwed conduits and inspection fittings, fool-proof switchgear, I.E.E. grade cable.

3. Lighting Installations.—(*a*) Welded conduit and grip fittings, I.E.E. grade cable; (*b*) lead or alloy (twin cables) and fittings; (*c*) *for damp situations*: c.t.s. cable, mounted on bobbin cleats, and front recessed blocks for mounting fittings.

The use of capping and casing and v.i.r. cables run on cleats should be restricted to surface wiring only, and should not be allowed in very hot or damp situations.

I shall be glad to read some further suggestions on this subject.

Horace J. Arthur.

Wolverhampton, *July 22nd*, 1922.

The Electric Cooking Load.

For several years I have been endeavouring to get the South Metropolitan Electric Light & Power Co., Ltd., to supply sufficient electricity to my private house, which is connected to its mains, to enable me to carry out electric cooking in a proper and thorough manner. As it is, I have only been able to get it to lay mains, at my expense, sufficient to give me a supply for lighting and cleaning purposes.

If the ordinary householder, who is no more interested in electricity than he is in gas, has to go to as much trouble to get electricity installed as I have done, I can well under-

stand that the electrical industry can never go ahead in a thorough manner. If I were to write to the gas company in a similar strain, asking it to give me adequate gas supply for any purposes, its representative would be waiting on my doorstep any time from 8 o'clock in the morning until 10 o'clock at night. The reply that I have so far received from the South Metropolitan Co. read as follows:—

"In reply to your letter of the 17th inst., we regret that the position is no better than it was when we were last in communication with you regarding heating load at your residence, and the demand you have now installed is the maximum we can deal with on our existing network."

Are you, or any of your readers, able to advise me what other steps I can legitimately take to get the supply I need?

L. G. Hawkins.

London, W.C.2, *July 19th*, 1922.

More Opportunities for Business.

It is gratifying to note that at least one reader was sufficiently interested in the possibilities of electric trucks for milk distribution to add to my remarks on the subject. I quite agree with Mr. Gavin Ralston that co-operation is necessary between the suppliers of electricity and the builders of trucks, and would suggest that, as it is easier to create a new tariff than to make a new pattern of truck, the suppliers should make the first move by offering an attractive price for what ought to be a very attractive load.

There must be many men who, having piled power on to lighting, heating on to power, and then cooking on to the rest, would like to consign their "day" load to the bottomless pits that yawn between their dizzy peaks. To such the trade-vehicle battery should come as a veritable godsend, for it should be easily arranged as an off-peak load.

Another dam that should make possible the filling of the valleys between the peaks is the lighting of surrounding villages by means of local batteries charged during selected hours by motor generators across the outers of d.c. towns (or a.c. for the matter of that). There must be hundreds of villages and suburbs within two or three miles of a town, where the conditions would make it worth somebody's while to buy electricity at 1d. or 1½d. and sell it at 9d. or 1s. per unit.

The town clerk of this particular town tells me that it cannot be done, because the Corporation has no power to sell electricity *inside* the borough boundary for use *outside*. The Electricity Commissioners say that it is a legal question, and refuse to give an opinion. Remembering, after the first shock, that the "law is a hass," one is led to wonder what would happen if a man, whose house was on the borough boundary, dared to light those rooms that happened to be just outside the enchanted line! One remembers that various garages in the town use the supply to charge customers' batteries which are used outside the borough. In fact, it is difficult to see why the local authority should concern itself as to the place of use of its electricity, so long as the supply is taken at a point within its area and is metered and controlled to the satisfaction of its engineer.

This particular town not only has its circle of suburbs and villages, but has within easy reach its workhouse, where gas to the value of some £600 per annum is used for lighting. About half this sum could be saved by the use of electricity, to the double benefit of the ratepayers, but so far it has proved impossible to cross the magic circle drawn round the borough by the legal Merlins. The plain man may well feel as bewildered as the Yankee at the Court of King Arthur, and I shall be glad if someone can either break the spell or explain the situation.

F. R. Cripps.

Worthing, *July 24th*, 1922.

Where are the Wiremen?

I have read the letter in your present issue under the above heading, signed "Engineer," and consider he must be hard put to it not to be able to find any wireman suitable for his job within a few hours out of all his 200 replies.

Being myself one of the applicants with a varied experience with contractors, chiefly in the North, I have waited in vain for some sort of intimation that the vacancy was filled or I was being considered.

"Engineer" must be very fastidious and lax if he requires more than a week to choose and consider the merits and capabilities of his applicants for so simple a job.

My own application was brief, perhaps too brief, but I was afraid to give many details more than just those of the jobs I had done, and omitted some of my previous employers' names and their references, except the last one, for whom I was foreman, for fear of making the letter like an autobiography.

What more does "Engineer" want than a very few plain facts simply told, which should bring an interview for a fuller cross-examination, production of references, and agreement for wages, without a lot of formalities, preamble, and embellishment to convince him that this or the other applicant is suitable?

One Applicant.

July 21st, 1922.

The assertion made by "Engineer" in your current issue is astounding, to state the case mildly.

A lay reader of our leading technical journal might well assume that the unemployed of the electrical trades consist mainly of incompetents and wasters.

The alternative inferences are, either that the advertiser was unfortunate in the type of applicant (a reflection I am not disposed, personally, to make), or that the remuneration offered was not sufficient to secure a competent man—even though there are many, unfortunately, who are reduced to subordinating their hopes of adequate wages to the necessity for mere subsistence.

The writer, personally, although answering the requirements pretty closely, and extremely desirous of steady employment rather than the fragmentary sort that now is a little less difficult to find, gave the "advert." a "miss" because of the usual objection—the box number. One does not wish to detail one's private affairs to a stranger who does not disclose *his* name and standing in the trade, while he asks personal particulars from the many.

His man *is* obtainable, may I suggest with all respect, if he will but go the right way about it. He might do worse than apply to the Secretary of the London Electrical Engineers' Old Comrades' Association, whose name and address I take the liberty of enclosing.

Ex-L.E.E.

July 22nd, 1922.

My attention has been drawn to the letter appearing in the current issue of your valuable paper, signed "Engineer," and dealing with the subject of wiremen.

I am directed to say that members of this Association, owing to the slump in trade, have had to reduce their staffs, and that to their knowledge a number of competent wiremen are at present unemployed.

If "Engineer" will get in touch with me, I shall be pleased to assist him in obtaining the man he desires.

A. Brammer,
Gen. Sec., National Assocn. of Supervising Electricians.

London, E.C.4, *July 24th*, 1922.

In reply to "Engineer's" letter in your last issue stating his experience with young wiremen, it certainly appears possible that out of two hundred applicants a suitable man should have been available; but why is a young man required? Is it because the wage offered would not attract a thoroughly practical man? Many of the young men have had rather a broken apprenticeship owing to the war, and, as trade has been since the Armistice, have not had much opportunity of gaining further experience.

Are we going back to the "too old at forty" stage again? The firm by which I was employed before the war has been unable to keep me on (although giving me a first-class reference), but those men who did not join up but stayed at home and got the big money are retained, the ex-Service men being the first to be stopped now things are slack. I have spent over £50 this year advertising, answering adverts., and interviewing firms. I have also inquired at many Labour Exchanges, but have never yet drawn the dole. I should be very glad of a job such as "Engineer" offers, and, having had charge of plant up to 200 kW and carried out complete installations up to 200 points, perhaps I could manage the job without getting "mixed up"; but, alas, I am no longer a young man, being now 39, and those few years on the other side jumping out of trenches, and no boy to carry the "tools," seem to be costing me very dearly.

Indentured Electrician.

July 24th, 1922.

In reply to "Engineer," I was one of the 200 applicants for the position as "handy man, age 35, thoroughly experienced, and practical electrician, wiring and all systems, telephones, motors, generators, overhead work, &c., and quite willing to do any kind of work, electrical or otherwise."

I have written for 70 jobs in different papers, and never had one reply, although in a good many cases I enclosed stamped addressed envelopes.

I am quite willing to go anywhere or do anything, and let the man who employs me give me what he thinks I am worth. I am not a member of the E.T.U., but have been for 10 years, and if anyone likes to give me a trial I will work on payment by results or living wage.

Wireman.

July 24th, 1922.

In reply to "Engineer's" query, I should like to point out that apparently he is asking for a "handy man" and not a specialist; therefore, he may experience some difficulty in obtaining a man with qualifications to cover the three branches of the profession stated, *i.e.*, wiring, overhead line work, and general station work. Also the applicants are probably singled out by their letters and references, and I suppose the man who "tells the best tale" gets the job, the rest of the 200 sharing in the distrust raised by the incompetency of the favoured few; but I suppose this is unavoidable while the present methods of "getting into touch" between employers and applicants prevail.

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In conclusion, I may add that there are men who, although they do not possess references covering the specific duties or a life experience, are sufficiently ambitious and adaptable to fulfil satisfactorily the position of handy man.

Fed-up Applicant.

July 22nd, 1922.

"Engineer's" letter is rather amusing, if it were not so tragic. Here is a man, who uses a nom-de-plume, with 200 applications in his hand wanting someone to recommend an electrical "combination." Who would risk a recommendation to one who considers that one-half per cent. of the applications are not satisfactory? I hold a similar position to that he describes, *i.e.*, a general electrician, and I know at least 20 good men who would jump at and work hard for a situation the like of "Engineer's." Possibly he has judged the 200 by their letters; if so, I would like to remind him that out of the 200, possibly 150 would be good men (but not correspondence clerks), which is much more than one-half per cent., as suggested. Possibly also the "root of the trouble may be at the top."

Not 1 in 200.

[As the result of "Engineer's" letter, we have been inundated with letters for transmission to our correspondent, as well as with letters intended for publication in these columns. Many of the applications are backed by copies of most excellent testimonials, and some are from men who had already answered "Engineer's" advertisement. Practically all of those open to our perusal reveal an intense desire to secure employment, and it has been a painful task to deal with the correspondence, which shows beyond question that many able and experienced craftsmen are out of work. They have our sincere sympathy. We regret that we cannot afford space to print more than a few of the letters.—EDS. ELEC. REV.]

Civil Service Examinations.

Referring to Mr. F. E. Price's letter published in your issue of July 7th, it may also be of interest to your readers to know that "personal qualities" as an examination subject was included by the Civil Service Commission as long ago as 1912, when what I believe to be the first examination for assistant engineerships in the Post Office Engineering Department, following the reclassification of the engineering staff, was held. In that case the maximum number of marks obtainable for personal qualities was 600 out of a total for eight subjects of 2,100. In the examination held the following year the proportion was increased to 800 out of a total for the same subjects of 2,300. Fifty per cent. was required for a pass.

H. Kingsbury.

London, *July 18th*, 1922.

British Orders for German Products.

In your issue of April 7th last I read with surprise, not to say indignation, that the Corporation of Dundee had accepted a German tender for electric cables, and that Edinburgh Corporation had accepted another German tender for rails. I wonder if the gentlemen who accepted these tenders realise the untold harm that the accepting of foreign tenders for the home market does to our export trade.

As a representative in Brazil of an engineering firm, I feel very strongly about this matter, as these orders for the supply of material to the home market are at once used for propaganda work here in South America, with dire results to British export trade.

To a man residing abroad, reading the papers from home that inform him that there are one million men unemployed at home, it is impossible to understand why, when public bodies have need of material, they cannot order this material from home manufacturers, and thus employ at least some of the unemployed, so that our people may be self-supporting and not exist on charity doles from the Government.

I wonder how much money per week the Edinburgh and Dundee Corporations are paying out to the unemployed, and if the small amount saved by accepting these German tenders would be sufficient to meet the case. We poor men abroad who are doing our utmost to secure orders for home, and are up against fierce competition from Continental firms, have the satisfaction of getting stabbed in the back by corporations like Dundee and Edinburgh awarding contracts to our worst competitors.

If the Labour Party would take these matters up instead of indulging in useless strikes, it would be to the benefit of everyone, more especially to the unemployed.

An Engineering Representative.

Brazil, *June 26th*, 1922.

Wireless Valve Sets.

There seems to be a considerable amount of doubt existing with regard to the above, and we think it would be as well, in the interest of the public, if the correct facts were stated.

There are a number of valve sets being made by small firms and sold to amateurs. Is there any possibility that after having purchased these sets they will not be allowed to use them when broadcasting begins? Are these sets on the market infringing any patents, and would the purchaser be liable to have his apparatus confiscated? Why are the larger manufacturers sending round their representatives to sell wireless apparatus, who state that they are making valve sets, but for some mysterious reason they cannot sell them at the moment? What are really the patentable details in a valve set?

We think if these few points could be made clear to the general public, they would then be in a position to judge whether they are wise in purchasing sets at the moment.

Walsall Electrical Co., Ltd.
V. DELEBECQUE.

Walsall, *July 18th*, 1922.

[The valve sets on the market at the moment are apparently suitable for the reception of short-distance messages only; those capable of receiving messages from, say, the Continent are as yet too expensive to find a ready sale amongst amateurs. It must be assumed that the receiving sets already on the market do not infringe patent rights, otherwise they would not be offered for sale. Whether a limited number of manufacturers only will be permitted to produce such apparatus is not known; that is presumably one of the matters to be settled by the Post Office authorities when deciding the conditions on which broadcasting will be allowed. The whole thing seems to have been excellently stage-managed and advertised—but nothing practical has been done yet. Manufacturers will obviously not commence to produce receiving apparatus in any quantity until the broadcasting stations have been established.—EDS. ELEC. REV.].

Power to Supply Electricity.

A company in our town known as the ———— Gas and Electrical Co. a little while ago reserved the power to prevent any electricity supply entering the district other than that furnished by themselves. This company had been in operation for some time, but had never generated any electrical energy either for themselves or for consumers. This supply was discontinued some few months ago. Now we have a local brewery supplying consumers, their mains in a great many instances crossing the main roads; furthermore, they are conscripting sales for electrical accessories. We being the only electrical contractors, should like the satisfaction of knowing whether their supply is legal, and if we could not have the same method of supplying. We hope you will consider this as a fair appeal to safeguard the contractor and also consumers. In conclusion, we should like to say that this brewery was approached by us a short while ago with a view to their supplying us at their voltage, but we were promptly refused on the grounds of insufficient power, and yet these people continue to take on additional consumers; can you advise us on the matter? Possibly some of your readers may have been in the same plight, and would perhaps give us the benefit of their experience.

One Who is Losing Private Plant Jobs.

July 19th, 1922.

[The brewery company appears to be acting quite legally, as, we understand, there is no authority in existence which possesses statutory powers to supply electricity in the district. It is open to our correspondents to commence a similar business, and to carry overhead mains across the roads, provided that the regulations are complied with; and if the plant capacity does not exceed 50 kW, there is no need to notify the Electricity Commissioners that the supply is being given. Where the supply is "unauthorised," as in the case of the brewery company, there is no obligation to supply anyone; the company can choose its customers, and charge any price that the consumers agree to pay.—EDS. ELEC. REV.]

[A number of letters have been unavoidably crowded out this week.—EDS. ELEC. REV.]

United States Electric Vehicle Market.—Conditions in the electric vehicle market showed little change last month. One of the most significant developments during that month was the appearance of a full-page advertisement in the *New York Times* announcing reductions of from 35 to 40 per cent. in the prices of one of the most popular makes of electric trucks; the manufacturer's agent in New York informed *Reuter's Trade Service* representative that the advertisement was the first of a series. Another electric truck manufacturing company has also started an advertising campaign in the daily Press, using smaller space. One truck manufacturing concern reports that its sales during the first five months of this year showed an increase of 600 per cent., as compared with the corresponding period of 1921. Insurance companies recently granted a further reduction of 15 per cent. in premiums for public liability and collision risks covering electric trucks, so that the rates are now 25 per cent. below the premium for gasoline-driven vehicles. Twenty electric trucks and passenger cars, valued at $35,791, were exported from the United States during April.

LEGAL.

Marconi's Wireless Telegraph Co., Ltd., v. Mullard Radio Valve Co., Ltd.

In the Chancery Division, on July 19th, this action came on for hearing before Mr. Justice P. O. Lawrence. The plaintiff company claimed an injunction to restrain the defendants from infringing their Letters Patent Nos. 28,412 of 1913 and 126,658, and for the delivery up of the articles made in alleged infringement of the Letters Patent, and also for damages.

It appeared that the plaintiff company were the owners of the Letters Patent No. 28,413 of 1913, granted to the company and Mr. Henry Joseph Round for an invention of "improvements in receivers for use in wireless telegraphy," and also of Letters Patent granted to Michael Peri and Jacques Biguet for the invention of "improvements in or relating to vacuum tubes." The plaintiffs alleged that the Letters Patent were valid and subsisting, and they complained in particular of the sale by the defendants on or about July 8th, 1921, of "2R valves" constructed in accordance with the invention described in the complete specification of the Letters Patent of 1913, and in all the claiming clauses of the complete specification of the Letters Patent numbered 126,658.

Defendants denied the alleged infringement. They admitted that they sold and manufactured considerable numbers of thermionic valves, but they alleged that in part such manufacture and sale was by them as agents or contractors for His Majesty's Government, and in particular the Admiralty, on written authorisation in that behalf, and they denied that these valves constituted an infringement of either of the Letters Patent, and they relied on the provisions of Section 29 of the Patents and Designs Acts, 1907-1919. Defendants further alleged that the Letters Patent in question were and had been at all material times invalid.

Mr. J. Hunter Gray, K.C., Mr. Trevor Watson, and Mr. J. Whitehead appeared for the plaintiffs, and Sir Duncan Kerly, Mr. Moritz, and Mr. Courtney Terrell for the defendants.

Mr. Hunter Gray explained to the Court the function of the thermionic valve in wireless telegraphy, and experiments were conducted enabling his Lordship to judge the value of the device.

Mr. J. S. Vincent Pletts, M.I.E.E., Fellow of the Chartered Institute of Patent Agents, was the first witness called in support of the paintiffs' case. His evidence related to the technicalities of the construction of valves as showing the inventions registered by Letters Patent were unexplored ground up to the time those patents were granted. He said he knew of no valve which was in use now except the Round valve, which was cheap and robust. The defendant company's valve came completely within the plaintiffs' patent.

On July 20th Mr. Pletts was cross-examined by Sir Duncan Kerly. He explained the extent, in his view, of the invention by Mr. Round, and what, in fact, this invention actually consisted of. He said the advantages of Mr. Round's cylindrical construction were that it protected the glass from the electrons; it enabled one to control the flow of the electrons; it protected the space charge from external charges; and it also gave the shortest and broadest path between the electrodes, *viz.*, from the filament to the anode. Witness said he agreed that the claim was limited to boxing-in the grid by enclosing it only electrically all round, not mechanically all round. Round's general idea was to cut the line between the glass and the filament so as to prevent the electrons from getting to the glass. He did not agree that Mr. Round's specification was confined only to preventing the electrons getting to the glass. He did not agree that Mr. Round's to protect the space charge from the influence produced on it by the electrification of the glass. He agreed that whether a vacuum tube constructed with a grid and plate surrounding the filament gave a satisfactory or good characteristic curve depended, *inter alia*, on the dimensions and positioning of the parts. He admitted that in the case of the defendants' valves if the plate were taken away, the glass would be exposed to the electrons. It was the common practice in physical experiments in investigating electron currents to have the anode arranged as a cylindrical plate round the cathode.

The hearing was adjourned until July 25th.

The King v. The Electricity Commissioners (*ex parte* The Ealing Borough Council).

As briefly stated in our last issue, on July 19th the Court of Appeal, consisting of Lords Justices Bankes, Warrington, and Atkin, delivered judgment in this case, in which the Commissioners showed cause against a rule *nisi* of a *mandamus* directed to them calling upon them to give their approval to the provisional agreement entered into between the Ealing Borough Council and the Hammersmith Borough Council for a supply of electricity.

Lord Justice Bankes, in giving judgment, said this was an application by the Ealing Corporation to the High Court asking the Court to exercise what he thought was a very important branch of its jurisdiction. It was, perhaps, unnecessary to say that the issue of the writ was a matter of discretion, and not of right. The complaint in this case was that the Commissioners had acted in excess of the jurisdiction conferred upon them by the Electricity (Supply) Act, 1919. Applying the test of what had been ordered by the late Lord Justice Farwell in the case of the King *v.* the Board of Education (*ex parte* the Managers of the Oxford Street School, Swansea) it was contended that the Commissioners had acted on a mistaken assumption of jurisdiction, and the question was whether, in the circumstances of the case, that charge had been made out. For that purpose it became necessary to consider the provisions of the Act, its general objects, and the means by which those objects were arrived at. The general object of the Act was to consolidate large areas for the supply of electricity, and to place such areas under certain electricity authorities. In the selection and formation of those areas conflicting interests might, no doubt, have to be dealt with, and some considerable time might elapse before a scheme could be brought out. It was obvious that in the proper exercise by the Commissioners of their jurisdiction existing local authorities might have to submit to what was an immediate disadvantage in a matter which the Commissioners believed to be to the ultimate advantage of the larger scheme they had in view.

Having read Section 7, Sub-sections I and II of the Act, the Lord Justice proceeding, said that not only had the Commissioners to formulate a policy, but they had then to hold an inquiry and make an order, which, however, did not become operative until it had been confirmed by the Board of Trade and approved by both Houses of Parliament. For that reason the Legislature had made certain transitory provisions to cover the period until a scheme could be fully approved and come into force. His Lordship then read Section 19 of the Act, which he said was really the relevant section in the case. He then reviewed the facts of the case as set out in our issue of June 2nd (p. 766) leading up to the application of the Ealing Borough Council for a rule *nisi*. He said that it had been urged, on behalf of the Commissioners, that Parliament intended them to have a much wider authority; that they had the right to formulate their policy as to the consolidation of areas; that much time would probably be required in order to bring that policy into effect; and that although mutual assistance might be necessary, such assistance could only be given subject to their approval. Their right to refuse the assistance must be allowed if the policy suggested cut across the line of policy they had proposed to adopt.

In his judgment the words of the section must include the jurisdiction claimed on behalf of the Electricity Commissioners, and although it might work harshly in a particular case, when once it was established that the refusal had been made *bona-fide* he thought the complainants must submit. For these reasons he thought that cause had been shown and that the rule must be discharged.

The other members of the Court delivered judgment to the same effect.

Contravention of Electricity Regulations.

In the Justiciary Appeal Court, Edinburgh (before Lords Ormidale, Hunter, and Ashmore) last week, an important case, involving alleged contravention of electricity regulations was decided. The appeal was lodged by Andrew Fotheringham, H.M. Inspector of Factories, 250, St. Vincent Street, Glasgow, against Babcock & Wilcox, Ltd., Renfrew, against whom a charge of contravening the electricity regulations made under the Factory and Workshops Act (1901 to 1911) was brought at Paisley and dismissed by the Sheriff-Substitute. It appeared that the firm was constructing a new pipe shop in which an electric overhead crane was being erected. John Young, employed by the respondents as an engineer's labourer, was sitting on the end carriage of the crane drilling a hole with a ratchet. Over the place where he was working, at a distance of 4 ft. 3 in. above the frame, were three live electric trolley wires carrying a 440-volt three-phase alternating current. These wires were not protected in any way. They were necessarily bare, although capable of being protected. In the afternoon of December 22nd Young was found dead hanging by his two hands on the live wires above the platform of the crane near where he had been working. He had no electrical knowledge, but had been warned by the electrician under whose instructions he was working that it was dangerous to come in contact with them. The contravention charged against the respondents was that they failed to provide and use portable insulating stands, screens, boots, gloves, or other suitable means, in consequence of which neglect Young was killed.

On the assumption that the regulations applied, the Sheriff-Substitute held, looking to the circumstances of the case, to the nature of the work upon which Young was engaged, to the fact that he had been warned that the wires were dangerous if he came in contact with them, and to the fact that he could proceed to and return from the spot where he was working with safety if he used reasonable care, that the respondents were not guilty of a breach of the regulations, because, in his opinion, it was not necessary adequately to prevent danger that the means specified in the regulations should, in the circumstances, have been provided and used by the respondents. The prosecutor (H.M. Inspector) appealed,

and it was argued on his behalf that the fact that Young had been killed showed the need for the protection of these wires, of the danger of which he had been warned.

The Justiciary Appeal Court sustained the appeal, holding that the Sheriff-Substitute ought to have found the charge proved on the ground that the necessity for protection had been demonstrated by the death of Young, and that the regulation was intended to secure the safety, not only of careful workmen, but of workmen from inadvertence or carelessness.

THE ATTORNEY-GENERAL AND THE BIRKDALE DISTRICT ELECTRIC SUPPLY CO., *v.* MAYOR AND CORPORATION OF SOUTHPORT.

In the Chancery Division, on Monday (July 24th) Mr. Justice Eve gave judgment in the action brought by the Attorney-General and the Birkdale District Electric Supply Co. against the Corporation of Southport to restrain the latter from infringing the plaintiffs' rights in connection with the supply of electric power in the Birkdale district. (The hearing was reported in the ELEC. REV., July 14th, p. 49.)

His LORDSHIP, in giving judgment, said that on April 1st, 1912, the boundary of the borough of Southport was altered by statute so as to include the urban district of Birkdale. At that date the Birkdale District Electric Supply Co., Ltd., by virtue of an indenture dated December 31st, 1901, was the transferee of the powers, duties, and liabilities conferred and imposed on the Birkdale Urban District Council by an electric lighting order of 1898. It was also lessee for a term of 99 years from February 2nd, 1901, of an electrical generating station in Birkdale, and by virtue of a second indenture dated December 31st, 1901, was under contract to generate within the urban district of Birkdale all electrical energy required for public and private lighting under the Electric Lighting Order, 1898, and for working any electric tramways owned by the Council in the same district.

At the same date, April 1st, 1912, it was generating and supplying electricity within the urban district for lighting the town hall, fire station, library, and other public buildings, 17 public lamps in the neighbourhood of the town hall, and the lamps on the standards along the tramway route, and for working the tramways belonging to the Urban District Council, and then in lease to the Southport Tramways Co., Ltd., for a term of 35 years from January 1st, 1902. By the lease the Tramway Co. was prohibited from taking electrical energy from any other source. The conditions regulating the supply of electrical energy for working the tramways and lighting the lamps on the standards along the route was contained in an agreement of November 7th, 1902, made between the relators and the Tramway Co. In the second indenture of December 31st, 1901, was contained a covenant of the District Council that it would not, so long as the powers, duties, liabilities, and works authorised by the Electric Light Order of 1898 were vested in the relators, apply for any Provisional Order under the Electric Lighting Acts or consent to the grant of an Order to any person or company in respect of the area of supply mentioned in the Order, or to the supply of electrical energy by any company, corporation, body, or person within such area of supply, and by the Order extending the boundary of Southport, it was provided that all contracts and agreements subsisting at the commencement of the Order entered into or made by the Urban Council in relation exclusively to any part of the added area should continue as if the Southport Corporation had been a party thereto. When, therefore, the borough boundary was extended to include Birkdale the only result so far as the relators were concerned was to substitute a reference to the Borough Corporation for any reference to the Urban Council in the Lighting Order of 1898, and in the indentures of December 31st, 1901, and it was not contended on behalf of the Corporation that under the Extension Order of 1911, or otherwise, it acquired any right to supply electricity in competition with the relators. The real contest between the parties turned upon the true construction of the word "supply" in the phrase "to supply electrical energy." The tramways in Birkdale were in a continuous line with those in the borough of Southport. From the time of the extension and until quite recently the Corporation provided power for driving the cars up to the old borough boundary, and the relators provided it for driving them beyond that point. In February, 1918, the Tramways Co. surrendered to the Corporation, *inter alia*, its lease of the tramways in the old Birkdale district, and thereupon the Corporation became owner of the whole length of the tramways. The effect of the surrender was to put an end to the agreement of November 7th, 1902, between the relators and the Tramway Co., and accordingly a fresh agreement, dated October 3rd, 1918, was entered into between the relators and the Corporation, which, in effect, reproduced as from March 1st, 1918, the conditions *mutatis mutandis* of the earlier agreement except that instead of being determinable on the expiration of the leasehold interest it might be put an end to at any time by three months' notice from either party. On August 10th, 1921, the Corporation gave three months' notice to terminate this agreement, and it ended at midnight on November 10th. Thereafter the cars were, and since had been, propelled along the whole length of the line by power generated and provided by the Corporation. The relators asserted that the Corporation in these circumstances were acting in breach of the contractual restrictions against assenting to the supply of electrical energy in Birkdale in competition with the relators imposed upon it by the second indenture of December 31st, 1901, and had instituted this action to obtain an injunction to stop further breaches of the agreement and to recover damages for those that had already been committed. The Corporation, on the other hand, denied this, and said that it owned the tramways, and it could not in any sense be said to be supplying electrical energy. It argued that in order to supply energy there must be two parties—one who gave and the other who took. The primary meaning of the verb "to supply" was, his Lordship thought, to give or furnish something which was wanted, and in that sense it could be construed, in the relevant places in which it was used in the Acts and Orders his Lordship had to consider. In that construction there was little, if anything, to distinguish it from the verb "to provide," and in cases where the local authority was itself the undertaker inasmuch as its statutory buyers included "supplies of electricity for public purposes," that was, *inter alia*, for lighting in the street or in places belonging to the local authority—the verb "to supply" was certainly used with reference to a state of facts which did not involve the transfer of electricity from one who gave to another who took, unless it could be said that the local authority as electricity undertaker was to be treated as a separate entity from the same authority as owner or controller of the lamps in streets and places belonging to it. In the case of the West Surrey Water Co. *v.* the Guardians of the Chertsey Union, 1894 (3 Chancery Division, p. 513), Mr. Justice North, in the circumstances involved, in face of the plaintiffs' monopoly of supply, had to consider the meaning of the word "supply" in relation to water under the Public Health Act, 1875, and he attached a construction to it which would appear to exclude all cases where the supplier and the consumer were the same body and where the commodity was provided not to persons in the area who required a supply, but for use by the suppliers for their own purpose. His Lordship thought that the result of this judgment was to impress upon the word "supply" in the Acts and Orders of the nature of the present ones a meaning which compelled him to hold that the plaintiffs had no cause for action, and this being so, he had no alternative but to dismiss this action with costs.

ENGLISH ELECTRIC & SIEMENS SUPPLIES, LTD., *v.* LAWRENCE.

In the Mayor's and City of London Court, on July 20th, the plaintiffs made a claim against Wilfred Lawrence, electrical engineer, of Chelston, Torquay, for £7 17s. 6d. for electrical goods supplied. Defendant, in his affidavit, stated that he handed over his business and entered into a deed of agreement with Mr. Hawkins, of Charterhouse Square, London, on December 7th, 1920. He contended that from that date the business at Torquay belonged to Mr. Hawkins, defendant being the manager. Plaintiffs' goods were supplied in April, 1921. Plaintiffs said they had never heard of Mr. Hawkins being the defendant's trustee. The defendant had the goods. Judgment for the plaintiffs, with costs.

THE LIGHTING DYNAMO AND EQUIPMENT CO. *v.* GREEN.

At Marylebone County Court, on Monday, before Judge Scully, plaintiffs, of 6-7, Warwick Mews, Warwick Place, W., sued S. Green, of 1, Formosa Street, Warwick Avenue W., for £11 9s. in connection with the wiring of a shop and back room and for extras supplied.

The case for the plaintiffs was that an estimate for the work at £12 was submitted to defendant in August, 1920. It was a verbal estimate, and there was nothing in writing. Defendant accepted the estimate, but when the work was carried out defendant refused to pay for it. Plaintiffs also supplied some electric lamps. The contract did not include the cost of effecting a connection with the main. There was a deposit paid.

In reply to the judge, a witness for the plaintiff said he gave the company which was to supply the electricity notice of the work when it was completed.

Defendant said the contract was that the cost of making the connection with the main should be included in it. The only money he was told he would have to pay beyond the contract was £3 deposit for the meter. When the work was finished he was told by plaintiffs that they were going to leave it to the suppliers of the electricity to make the connection, but when he came into communication with them on the subject they told him the connection would cost him £30. There were no electricity consumers on either side of his house. Later, plaintiffs wanted payment for the fixtures, and he told them he did not want the fixtures.

In cross-examination defendant said he thought the suppliers of the electricity might want something—£5 or so—but he did not think they would require £30.

Judge SCULLY said it was very embarrassing to have to decide the case on inadequate evidence. The person who submitted the estimate and made the contract was not called on behalf of the plaintiffs, and neither party had produced a representative from the electricity company which was to give the supply; he must, therefore, give judgment for the defendant, with costs.

BUSINESS NOTES.

Bankruptcy Proceedings.—F. A. JENNINGS, consulting engineer, 25, Victoria Street, London, S.W.—Receiving order made July 19th on a creditor's petition. First meeting July 31st; public examination, September 19th; both at Carey Street, W.C.

R. SPRINGER, electrical engineer and contractor, 253, Plymouth Grove, Manchester.—First meeting August 4th; public examination August 18th, at the Court House, Manchester.

E. G. ROWE (Davies & Rowe), electrical engineer, 52, Eleanor Street, and 119, Dunraven Street, Tonypandy.—First meeting August 2nd; public examination August 18th, at the Court House of Pontypridd.

F. NICHOLLS, electrical and motor engineer, 19, South Street, Scarborough (trading in partnership with Mrs. M. Parks as The Scarborough Motor and Accessories Supply Co.).—Trustee (Mr. D. S. Mackay) released March 17th.

J. W. GLADWIN, electrical engineer, 81, Burcot Road, Meersbrook, Sheffield.—Trustee (Mr. C. Turner) released February 27th.

H. E. CARR, electrician, Carlisle Street, Goole.—Trustee (Mr. C. R. Townend) released April 11th.

Company Liquidations.—STUART & MOORE, LTD.—Meeting of creditors August 8th at the offices. Claims to the liquidator (Mr. J. J. Ure).

HUDSON'S ELECTRICAL ENGINEERING CO., LTD.—Meeting August 26th at 99, Albion Street, Leeds, to hear an account of the winding-up from the liquidator, Mr. W. Emmerson.

IMPERIA CO., LTD.—Meeting August 29th at 16, Kennedy Street, Manchester, to hear an account of the winding-up from the liquidator, Mr. A. F. Kearns.

ILFORD DRY BATTERY CO., LTD.—Meeting August 22nd at 31-4, Basinghall Street, London, E.C., to hear an account of the winding-up from the liquidator, Mr. G. W. Roberts.

TREDEGARS, LTD.—With reference to the report under this heading in our issue of July 7th, Messrs. Cecil Hodges & Co., Ltd., ask us to state that they are not the firm of Hodges and Co., who appear as creditors for £130 in the liquidation of Tredegars, Ltd. The latter company owed them nothing at the time of the liquidation.

AABADA TRUST, LTD.—Winding up voluntarily, with Mr. H. E. Harwood, 73-75, Albion Street, Leeds, as liquidator.

CONNER MAGNETO AND IGNITION CO., LTD.—Meeting of creditors August 8th at 31, Copthall Avenue, London, E.C.2. Liquidator: Mr. A. L. Wallis. Particulars to be sent in by date named.

Dissolutions of Partnership.—CABLES & ELECTRICAL SUPPLIES, merchants and manufacturers of electrical materials, Mica House, Offord Street, London, N.1.—Messrs. A. Bergl and J. F. Schofield have dissolved partnership. Mr. Bergl will attend to debts, &c., and continue the business at the same address.

H. F. KNOWLER & Co., agricultural, electrical, and general engineers, &c., Kingsnorth, Ashford, Kent.—Messrs. H. F. Knowler and W. R. and A. S. Cooper have dissolved partnership by the bankruptcy of H. F. Knowler and with the mutual consent of W. R. and A. S. Cooper, who will attend to debts, &c.

Deed of Assignment.—J. B. PHILLIPS and E. J. PHILLIPS (Phillips & Co., electrical engineers, 41, St. John's Road, Clapham Junction, London, S.W.).—Creditors' claims must be received by the trustee, Mr. W. A. J. Osborne, Balfour House, London, E.C., by August 2nd.

Trade Announcements.—Premises have been opened by MESSRS. JOHNSON & WATTS, electricians, at 180, Snargate Street, Dover.

THE WESTERN ELECTRIC CO., LTD., has appointed Messrs. Lionel Robinson & Co. sole selling agents for London, Middlesex, and Surrey, for its "B. A. G." diffusers. A range of samples is on view at the company's showroom at 3, Staple Inn, London, W.C.1, and catalogues are now being sent out to the trade.

Messrs. W. LILEY & Co., who removed early in the year to 62, Hope Street, Liverpool, where they have a showroom, state that communications are still being addressed to their former premises. Correspondents are asked to take note of the change, and of the fact that no alteration has taken place in proprietorship or in either their telephone or telegraph numbers.

We are informed that MR. G. W. MATTHEWS has ceased to hold the appointment of joint managing director of Messrs. Cesco, Ltd., wholesale electrical engineers, 8, Westgate Street, Cardiff, and MR. A. H. SMITH has been elected sole managing director.

Catalogues and Lists.—WESTERN ELECTRIC CO., LTD., 60 and 62, Finsbury Pavement, E.C.2.—An illustrated catalogue of "B. A. G." "diffusers," of many patterns, for gasfilled lamps.

THE LONDON ELECTRIC FIRM, Brighton Road, Croydon.—An illustrated leaflet giving particulars of suspended electric lanterns installed at Hove.

THE RELAY AUTOMATIC TELEPHONE CO., LTD., Marconi House, Strand, W.C.2.—A well-illustrated brochure giving a simple explanation of the "Relay" system, showing and describing the parts in very full detail.

IRONCLAD SWITCHGEAR CO., LTD., Monton Lane, Eccles, Manchester. An illustrated and priced catalogue of switch and fuse gear, including power station switchboards and distribution boards.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Catalogue Section K (13th edition), a comprehensive price list of telephone apparatus, fire alarms, water-level indicators, &c. Each item is illustrated, and views are given of a number of telephone installations. Also a card—"Reasons Why" No. 1, advertising "Excel" lampholders.

FULLER'S UNITED ELECTRIC WORKS, LTD., Woodland Works, Chadwell Heath, E.—List 111, describing the "Chad" battery for operating "wireless" valves.

BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—A series of leaflets giving a few "Auto Suggestions," *i.e.*, particulars of small devices for automobiles, including electric horns, Boyce "Moto-Meters," "Autoreelites," &c.

THE LAWRENCE PATENT WATER SOFTENER AND STERILIZER CO., LTD., Parliament Mansions, Victoria Street, S.W.1.—A leaflet dealing with the treatment of boiler feed water.

THE HORSTMANN GEAR CO., LTD., Newbridge Works, Bath.—An illustrated catalogue of time switches of various types.

Correction.—Owing to a printer's error in the arrangement of the advertisement, in our last issue, of SUPERLAMP, LTD., making an "Electric Lamp Offer," the prices of different lamps were mixed up. The advertisement is correctly printed in this issue.

New Belgian Companies.—There has been formed at Ondenval, Belgium, the Société Anonyme Lumière et Force Motrice for the production of electric light and power.

At Liége (24, Rue de Visé) F. Lambin and A. De Gueldre have constituted themselves a company for the carrying on of an engineering works and the undertaking of electric installations.

Joseph Herzé et Cie. is the style of a company formed at Liége for the sale, repair, and installation of electrical material of all kinds.

Brazilian Railway Electrification.—It is stated that the arrival at Rio de Janeiro of the president of the Compagnie Générale d'Electricité bears relation to the contract which the Government of Brazil is negotiating at present in order to provide for the electrification of the Central Railway of Brazil.

Outings.—In spite of rather unsettled weather, a very enjoyable day was spent on Saturday last by the indoor and outdoor staff of Messrs. Francis Polden and Co., Ltd., the London electrical contractors. A party of about 60 travelled in two charabancs to Brighton—the journey being enlivened by endeavours to follow up the weather changes by manipulation of the hoods of the vehicles. An excellent lunch awaited the party at the Clarence Hotel, Brighton, in the course of which an opportunity was taken of making two presentations to the head of the firm, Mr. Francis Polden—a silver rose bowl from the outdoor staff and a pair of silver-mounted brushes from the office staff. The spirit of fraternity between the management and the staff was very apparent, and this was given expression to by Messrs. Revell and Campbell, and, vociferously, by the assembled company. Mr. Polden thanked the staff for the gifts, and spoke of the firm's continued progress. He said that it was his aim to retain everybody with the company in spite of trade depression, and he was glad to say that so far it had not been necessary to "stand off" anybody. Mr. Oswald (co-director), in proposing the health of "The Staff, Indoor and Outside," also paid tribute to the excellent relations existing between all members of the firm, and Mr. Gill (secretary) responded. After lunch the individual members of the party were left to their own devices, and the weather behaved itself well for three or four hours continuously. The departure from Brighton was made at 5.30 p.m., and a diversion from the route was made for tea at Hurstpierpoint. The arrangements were in the hands of Messrs. Gill and Revell, and were another proof of the value of good business organisation.

For Sale.—By direction of the Disposal Board, Mr. Charles D. Phillips will sell a large quantity of plant and machinery, including boilers, water-softening plant, electric motors, generating sets, &c., at H.M. Factory, Stratton Works, Swindon, on August 16th and 17th. On August 15th and following days, Messrs. Bradshaw, Brown & Co. will sell by auction wireless material, electrical equipment, &c., at the Royal Dockyard, Woolwich. (See our advertisement pages to-day.)

Catalogues Wanted.—THE DUBLIN UNITED TRAMWAYS CO. (1896), LTD., 112, Marlborough Street, Dublin, is desirous of obtaining current issues of catalogues and price lists to replace those lost by the destruction of its Sackville Street offices.

Glow Lamp Works for Poland.—It is reported from Berlin that a Polish-Dutch lamp company has been formed at Warsaw with a share capital of 100,000,000 Polish marks and with the co-operation of the Dutch Philips' Glow Lamp Co.

The American Strikes.—Mr. Samuel Gompers, the president of the American Federation of Labour, has issued a statement inviting the Government to urge the miners and railway workers on strike, and their respective employers, to open direct negotiations. The Government, the Labour leader says, has threatened a great deal, but has had little to say about the rights of the workers. "Labour," the statement declares, "invites the Government to bring about a conference between the workers and employers. Labour will enter the conference in absolute good faith, and unless the employers are absolute autocrats, the strikes can quickly be adjusted."—*Reuter.*

Book Notices.—"The Home Radio: How to make and use it." By A. Hyatt Verrill (105 pp.; 61 diagrams). London: Harper & Bros. Price 3s. 6d. net.—It is stated in the preface that this work is not intended as a scientific treatise on radio telephony, but as an aid to those who wish to make or use wireless telephone instruments and "who are not interested in, or do not care to learn, the technicalities of practical electricity as applied to wireless work." The author goes further and considers that this ignorance is perhaps an advantage. Of course absolute lack of acquaintance with the subject is inconceivable, the author therefore outlines the theory and practice of "wireless" in a non-technical manner. A list is given of the tools and material required, and this looks rather formidable. Then the construction of instruments and components is dealt with, but parts of this section are often rendered superfluous by the author's concluding by saying that, after all, it is better to purchase the part in question either on account of the cost and difficulty of constructing it, or its inefficiency when home-made. Both sending and receiving sets are described in concise and simple terms. The little work will certainly be of assistance to amateurs, but we think that only the purchase and assembly of the parts described will give satisfaction.

"Maintenance and Repair of Electrical Measuring Instruments." By H. G. Yarrill (78 pp.; 7 plates). London: Percival Marshall & Co. Price 2s. 6d. net.—The author, who has had considerable experience in this class of work, devotes the first five chapters of his book to the classification of instruments under the headings:—Moving coil; moving iron; hot-wire; dynamometer; and electrostatic. Principles and construction are fully and concisely dealt with and peculiarities explained. The sixth chapter is devoted to the installation and maintenance of instruments in service. Chapter VII. deals with the cause and remedy of common defects, and the final chapter deals with repairing generally. The explanations given are simple, but, naturally, in such a small volume, somewhat compressed.

"Report on Water Power," being the report of a Commission of Inquiry into the Resources and Industries of Ireland (50 pp.; 5 plates). Dublin: The Commission (87, Grafton Street). Price 2s. 6d. net.—This report gives estimates of the power probably to be derived from the rivers Shannon, Erne, Bann, and Liffey, as well as a number of smaller water-power resources. It is admitted that, with the exception of the Shannon, only short-period gaugings were available to aid the Commission in its work. Previous inquiries into the subject are reviewed, and the establishment of discharge-gauging stations, &c., is recommended. The Commission has had recourse, to a great extent, to the proceedings of the Board of Trade Sub-Committee which reported on the subject a short time ago.

Publications of the Massachusetts Institute of Technology. Serial Nos. 28 and 29. Boston (Mass): The Institute.—The first of these two publications contains three short treatises:—"A Simple Harmonic Analyser," "Electromechanical Device for Rapid Schedule Harmonic Analysis of Complex Waves," and "Alignment Chart for Circular and Hyperbolic Functions of a Complex Argument in Rectangular Co-ordinates." The second describes a mechanical frequency meter of telephonic range (from the *Journal* of the Franklin Institute).

"Lexique Technique Anglais-Français," by G. Malgorn (216 pp.). Paris: Gauthier-Villars et Cie. Price 10 fr.—This is a work which will inevitably be of greater utility to the French engineer or industrialist than to the English, as only the French equivalent of English terms is given, although to firms who have to write to French customers it may be of value. The dictionary is termed "technical," but its scope is such as to usurp, to some extent, the functions of the general English-French lexicon. As is to be expected, some of the translations are open to question—"faculty," for instance, is given as "*force mécanique*"—a somewhat strained rendering, but nevertheless the items generally are very detailed and explicit. It is interesting to note how far France is indebted to the English language for its technical terms, even where they have been bodily, literally, and clumsily translated into French.

"*Proceedings* of the Institution of Railway Signal Engineers (Inc.), 1921." (350 pp.). Manchester: H. Rawson & Co. Price (to non-members) 7s. 6d.—In addition to the annual report and statement of accounts, and lists of members, this volume contains the papers read, with discussions on these, during the year. Included among these are "Some Problems of Automatic Train Control," by W. J. Thorrowgood; "Some Fundamental Calculations of a.c. Track Circuit," by D. C. Gall; "Magnetic Storms," by W. J. Thorrowgood; "Some Problems of Track Circuit Lay-out," by W. C. Ackfield; and "Light Signals," by W. J. Sadler.

Manual of Electrical Undertakings and Directory of Officials, 1922. Vol. 25. London: Electrical Press, Ltd. 30s. net.—This valuable—practically indispensable—work has now reached its twenty-fifth year. It is not a volume to review in the ordinary way; in the main all that one can do is to indicate the nature of the contents, and it is so well-known among those who have occasion to use such a work that even that need hardly be indicated here. However, for the benefit of those who make a regular practice of purchasing the new volumes, we announce that the 25th is now out; and for the information of those who usually have not gone further than to borrow somebody else's copy and ought to buy one for themselves, we may say briefly what it contains. Its contents comprise financial, technical, commercial, and general information (including names of officials) relating to 2,760 electrical undertakings. The aggregate capital issued by electrical companies registered in Great Britain, in shares, debentures, and loans, together with municipal electrical borrowings, is shown to stand now at £601,000,000, as against £541,860,000 in the previous year. The rates of dividend and interest paid by electrical companies for the past 20 years are recorded. There is a review and statistical analysis of the progress of the year, and the information in different sections relates to electricity supply and traction, telegraph and telephone, manufacturing and miscellaneous concerns. A section is devoted to Colonial and British possessions, and there are directories of officials, of members of Electric Lighting and Tramway Committees, and of electrical contractors, and there is an index to undertakings. All kinds of subjects are included in the review of the year's progress—water-power, wireless matters, the Electric Supply Bill, and so forth; there are various maps and other features such as the volume has made a speciality of for many years.

"Experiments with the Slide-wire Bridge," by David Robertson, D.Sc., M.I.E.E. (pp. 86+8). Chelmsford: Crompton & Co., Ltd. Price 3s. net.—As the preface states, this work has been written to illustrate the possibilities of the slide-wire bridge, and particularly that form of it developed by the author and made by Messrs. Crompton. Altogether 21 separate operations are described, and under each head details are given of several methods. The bridge, it is shown, can be applied to the measurement of resistance, especially in connection with fault-tracing; the measurement of conductivity; measurement of temperature by the resistance thermometer; and the calibration of dial boxes, ammeters, and voltmeters. Every experiment is illustrated diagrammatically, and the method of explanation adopted leaves little room for error.

"Science Abstracts." Vol. 25. Part 6, Section A.—Physics, and Section B.—Electrical Engineering. London: E. & F. N. Spon, Ltd. (for the Institution of Electrical Engineers). Price 2s. 6d. per part.

The Bureau International de L'Union Télégraphique has published a new list, in alphabetical order, of the call signs of wireless telegraph stations (7th edition); the price of the document is 6 fr. (Swiss), and it is obtainable from the Bureau at Berne.

"Elements of Radio Telephony," by W. C. Ballard, junr., M.E., pp. x+132; figs. 51. London: McGraw-Hill Publishing Co., Ltd. Price 7s. 6d. net.

"The Mechanical Handling and Storing of Material," by G. F. Zimmer, A.M.Inst.C.E., pp. xx +804; figs. 1,143. London: Crosby Lockwood & Son. Price £3 3s. net.

"The 'Union d'Electricité' and the Gennevilliers" (49 pp.; 53 figs.; and 5 special plans), translated by C. M. Popp from the original French of Ernest Mercier. Paris: *La Revue Industrielle*.—This English edition has been further improved by the addition of later photographs.

L'Oyonnithe Moulded Insulation.—The moulded insulation manufactured by the Société Anonyme L'Oyonnithe, of Paris, whose sole agent for the United Kingdom is Mr. S. Evling, of 2, Falcon Square, E.C.1, is particularly attractive on account of the perfection of moulding obtained, and the reliability of the finished article. Four different qualities of material are used, depending chiefly on the temperature which the moulding has to withstand. Tests carried out by the Laboratoire Central d'Electricité, France, in April, 1922, show that the insulation resistance and dielectric strength of the various materials are satisfactory, and the "Permanite" quality will withstand a temperature of 200 deg. C. without cracking or melting. These moulded pieces find a wide field of application for lampholders, adaptors, wall plugs, switch handles, insulating pieces for internal telephone and telegraph construction, magneto construction, terminal boxes, wall blocks, fuse-bar handles, &c., and for electro-medical apparatus, where the strength of material and finish are so important. Even the most complicated mouldings with embedded metal parts for the internal construction of electrical apparatus are turned out with accuracy and high finish from drawings or patterns.

Waste Through Rust and Corrosion.—We are informed that a proposal is on foot to form an Association of Manufacturers of Non-Corrodible and Anti-Corrosive Products with the object of creating new and increased demands for the products and processes of its members. This is in view of the recently-published estimate of Sir Robert Hadfield that the ravages of rust and corrosion represent an annual wastage of more than £500,000,000. Particulars can be obtained from Mr. W. R. Douglas Shaw, c/o The Royal Society of Arts, 18, John Street, Adelphi, London, W.C.2.

The Engineering Trade Position.—Mr. Douglas Vickers, M.P., in his speech at the annual meeting of Vickers, Ltd., at Sheffield on July 19th, said that 1921 was a year of troubles, disappointments, falling prices and diminishing trade for practically all the engineering concerns in the country. The only exceptions known to him were the textile machine trade, in which they were not interested, and the electrical trades. At the present time, with seven months of 1922 gone, there was no change for the better. If they did not know that trade must recover in the end and that every month brought them nearer to that revival, they would say that recovery was as far off as ever. The electrical trade still showed best, though orders did not come in as fast as work went out; there were very few inquiries for ships or steel products or railway material, carriages, and wagons; motor cars, on the other hand, were selling quite well. They were still waiting for armament orders, though their reduced designing staffs were very busy with new designs which they had been asked to get out, and which they must undertake if they were to retain that trade in the future.

There had been many conjectures as to the cause of the present bad trade, and few were satisfactory. The condition of Russia and the impoverished Central European States seemed inadequate as an explanation as far as engineering was concerned; the chief causes must be at home. "The customers for engineering products, ships, machinery, &c., are on strike. These goods are purchased almost entirely on capital account and paid for either out of profits retained in the business or by sums raised by new subscription. Excessive taxation has almost put a stop to the former, and as to the latter the investment of new money in plant at prices that are still high as compared with past years offers little attraction to the investor who can get a return from trust securities that compares not very unfavourably with what he used to expect on ordinary shares before the war. In fact, the investor has held off and will continue to hold off until there is some change in feeling. For the moment the outlook for the engineering trade is still gloomy, but there are points which indicate that the skies may clear. In the first place, the abundance of money is raising the prices of trust investments and bringing down the return that can be obtained from them, which must add to the relative attractions of industrial shares; secondly, there is a feeling spreading that things are improving, and if this feeling becomes general they will improve." . . .
"There is now plenty of money available for public loans and little for permanent investment in new construction or industrial enterprises. The market would readily supply large sums to our Dominions and Colonies if in certain cases the home Government would support loans by guarantees. Our old Dominions and Crown Colonies are still an ample field for development, while the newer acquisitions must have large sums spent upon them to become remunerative, or even only self-supporting units of the Empire. If development loans with a Government guarantee were spent in the usual proportions in this country, trade would revive, unemployment would be reduced, and the direct savings in the cost to the Government of unemployment could hardly fail to cover any eventual charge due to the guarantee, while the indirect advantages and the saving in local taxation would be far greater. Britain Overseas would again render great service to the mother country if they began development at once on a large scale. They would gain by their increased resources, and we here would be helped, now by the revival of trade, and in the future we should have the benefit of the newly-established customers for our goods of all kinds."

Belgian Electrical Signalling Apparatus.—Hitherto Belgium has been mainly dependent on foreign countries for railway electrical signalling apparatus. The Société des Ateliers de Constructions Electriques de Charleroi has, however, recently established special works for its manufacture at Ruysbroeck, near Brussels, where already a large number of orders are in hand in connection with the electrification of the Belgium State railways.

Holidays.—The works of the Electric Construction Co., Ltd., will be closed from August 5th to August 13th inclusive. The offices will re-open on August 9th.

The works and offices of Messrs. Allen West & Co., Ltd., Brighton, will be closed (save for urgent correspondence matters) from August 5th to 13th (inclusive) for the summer holidays.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

Blancol. No. 425,468. Class 50.—Oil intended for use to prevent or minimise the evaporation of electrolyte in secondary cells. Price's Co., Ltd., Belmont Works, Battersea, S.W. July 12th, 1922.

Magnome. No. 423,547. Class 13.—Electrical goods of ordinary metal. Frank B. Cox, 65, Fleet Street, Liverpool, July 19th, 1922.

Design No. 425,369. Class 13.—Water, gas, and electrical fittings of ordinary metal. Samuel Booth & Co., Ltd., Cheapside Works, Cheapside, Birmingham. July 19th, 1922.

Lecfurite. No. 426,163.—All articles in Class 5. Leeds Electrical Construction Co., Ltd., Charmouth Street, Leeds. July 19th, 1923.

Liliput. No. 416,919. Class 6.—Dynamos and electric fans. J. Stone & Co., Ltd., Abinger Street, Deptford, London, S.E. July 19th, 1922.

G. L. Garbe Lahmeyer (lettering and design). No. 419,672. Class 6.—Dynamos and electric motors. Deutsche Elektrizitätswerke zu Aachen, Garbe Lahmeyer & Co., Aix-la-Chapelle, Germany. Address for service: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C. July 19th, 1922.

Ackante. No. 424,692. Class 6.—Electrical machines. Justus Eck and Sergius Brook, trading in co-partnership, 4-12, Palmer Street, London, S.W. July 19th, 1922.

German Requests for British Posters.—The F.B.I. *Bulletin* publishes the following warning to members:—"The attention of the Federation has been drawn to certain communications which have been received from Germany asking for copies of propaganda posters issued at exhibitions and trade fairs in this country. The reason given for this request is that the posters are to be used as illustrations to a volume dealing with exhibition literature and advertisements. Investigations made show that there is grave doubt as to the purpose for which such posters, stamps, &c., are likely to be used, and any members receiving requests of this kind are asked to apply to the F.B.I. in order that the *bonâ fides* of the inquirers may be looked into."

Indian Imports.—Official figures issued by the Department of Statistics record that for the month of May the imports of manufactured articles showed decreases under machinery and millwork, Rs. 15 lakhs; railway plant and rolling stock, Rs. 63 lakhs; electrical goods, Rs. 26 lakhs, while metals recorded an increase of Rs. 66 lakhs.

New French Company.—There has been launched at Paris (10, Rue de Tilsitt) L'Electrotechnique, S.A., with the object of planning and carrying out electro-technical installations. Its capital is 170,000 fr.

LIGHTING AND POWER NOTES.

Australia.—New South Wales.—The Minister for Public Works has announced that a Bill is to be presented to Parliament next session providing for the installation of electric lighting systems to serve the towns of Moss Vale, Bowral, and Mittagong, and the erection of a transmission line from the Port Kembla power house. The estimated cost of the transmission line, including sub-stations, transformers, and switchgear, which will connect with the existing line at Avon Dam, is £32,000. Moss Vale already has a supply system, but the generating station will be closed. The distribution system for Bowral is estimated to cost £6,900, while the outlay at Mittagong is set down at £4,800.—*Tenders.*

Corowa (N.S.W.).—The Municipal Council has decided to convert its system of supply from d.c. to a.c. The estimated cost of the change over is £30,000.

Bath.—Year's Working.—The annual report on the working of the electricity undertaking for the past year shows a total income of £52,866, as compared with £45,495 in the previous year. Working expenses amounted to £40,029 (£38,070), leaving a gross profit of £12,837 (£7,425). After deducting loan charges, &c., there was a net loss of £1,504. In 1920-21 there was a deficit of £1,971.

Bexhill.—Year's Working.—The report of the borough electrical engineer (Mr. C. A. Frost) for the year ended March 31st, 1922, shows that the total revenue of the undertaking was £29,180, as against £24,698 in the previous year. The working expenditure was £18,960, as compared with £17,237, leaving a gross profit of £10,145 (£7,460). Capital charges absorbed £7,014 (£5,601), making the final result a net profit of £3,131 (£1,859). A total of 883,364 units was sold, being slightly higher than in the previous year, and the highest figure since the inception of the undertaking. During the year a 500-kW Belliss-Dick, Kerr set was put into commission.

Chislehurst.—Increased Charge Opposed.—The Urban Council is opposing an application by the Chislehurst Electricity Co. for permission to increase its charge for electricity from 10d. to 1s. per unit.

Continental.—France.—The French official journal has just published the text of the law of July, 1922, authorising the erection of networks for the transmission of energy at high pressure, and modifying the law of June 15th, 1906, concerning the distribution of energy. The new law provides that if the State itself does not take the initiative, it can compel producers, and, if necessary, distributors of energy, the Départements, communes, and public services in the same district which are interested in some form in the transmission of electrical energy, to constitute, under the direction of the State, and, in that case with the financial co-operation of the State, a special collective organisation for the construction and working of a network of high-pressure transmission lines intended particularly to connect the generating works between themselves and with transformer sub-stations from which the distributing

lines will start. If some of the producers or distributors of energy, whose co-operation is considered by the State to be indispensable for the realisation of a collective organisation of this nature or for its normal development afterwards, should refuse their co-operation, the State can (after the advice of the Committee d'Electricité) be substituted for them either by the purchase of their installations or by way of expropriation. The law further provides for the fixing in the annual Budget of the total amount of capital which the Minister for Public Works will be authorised to expend on the execution of works in accordance with this law.

According to the *Journée Industrielle*, the Bill authorising the construction of h.p. systems for the transmission of electrical energy in France has been adopted by the Senate. The object of the Bill is to provide for irregularities or shortage of water supply at various seasons. An annual saving in fuel after 1937 of 9,000,000 tons is anticipated as a result of the completion of present schemes. The cost of construction of the stations and systems is put at 15 milliard fr., a third of which will be supplied by the State.

Darlington.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to borrow £7,230 for two additional feeder cables.

Dungarvan.—Public Lighting.—The Urban Council has accepted the tender of the Dungarvan Electric Lighting Co. to carry out the lighting of the town at a total cost of £276 for the coming winter. The Gas Co. refused to tender on the ground that the state of the country was too uncertain.

Dunmurry (Co. Antrim).—New Company.—The Dunmurry Electric Power and Lighting Co. has been registered. Dunmurry is about four miles from Belfast, and possesses several large linen mills and factories.

Electricity District.—North-East Midlands.—The Electricity Commissioners are to hold a first inquiry at the Town Hall, Sheffield, on October 17th next with reference to the delimitation of the above-named district and to consider the scheme submitted by the Sheffield Corporation for the constitution of a Joint Electricity Authority for the area.

Edinburgh.—Price Reductions.—The Electricity Committee has recommended that the charge for electricity for lighting be reduced from 5d. to 4½d. per unit. A reduction in the charges for power, cooking, and heating is also recommended.

Gelligaer.—Extension of Supply.—The District Council is extending its area of electricity supply to Trelewis.

Greenmount (Bury).—Electricity Supply.—The Lancashire Electric Power Co. is canvassing the Greenmount district (near Bury) with a view to that neighbourhood being supplied with electricity, and the Tottington District Council has resolved that the company be asked to canvass the Bury Road portion of its area also.

Grimsby.—Year's Working.—The report of the borough electrical engineer (Lt.-Col. W. A. Vignoles, D.S.O.) for the year 1921-22 states that the gross revenue was £82,747, as compared with £67,415 in the previous year. The working costs amounted to £54,174, as against £51,525, leaving a gross balance of £28,413 (£15,890). The net result, after payment of capital charges, was a profit of £4,867, which was disposed of as follows:—Debit balance from the previous year, £2,654; motors purchased for hire, £756; reserved for purchase of cooking apparatus for hire, £1,000; transferred to reserve, £457. The total number of units sold was 5,272,929, as against 4,038,766, the increase being mainly due to larger sales of electricity for power purposes. The report mentions that a rateable-value system for private houses and a maximum-demand system for other premises were instituted on April 1st, the additional charge being 1½d. per unit.

Heywood.—Year's Working.—The annual report of the manager (Mr. H. C. Day) on the working of the electricity undertaking for the year ended March 31st last shows a total revenue of £20,024, as compared with £19,547 in 1920-21. Working costs and capital charges absorbed £21,071, leaving a net loss of £1,047. In the previous year there was a surplus of £829. The number of units generated was 2,246,253—a reduction on that of the previous year of 5 per cent. The production cost per unit rose from 1.53d. to 2.07d.

Kells (Co. Meath).—Borrowing Powers Refused.—The Local Government Department, Irish Free State Provisional Government, has declined to sanction the proposal of the Urban Council to raise a loan for an electricity scheme, on the ground that, there being no industrial concerns in the town, the annual revenue account would be less than the amount estimated.

Kilmarnock.—Loan Sanctioned.—The Electricity Commissioners have authorised the Town Council to borrow £200,000 for electricity purposes.

Llandrindod Wells.—Proposed Purchase of Undertaking.—The Municipal Council has, on the recommendation of its consulting engineer, opened negotiations with the Llandrindod Wells Electric Light and Power Distribution Co., with a view to purchasing the company's electricity undertaking.

London.—Stoke Newington.—The Borough Council has received a letter from Hackney suggesting the amalgamation of the electricity undertakings of the two boroughs, but has replied that it is of opinion that no useful purpose would be served by such a union.

Mynyddislwyn.—Extension of Supply.—The Urban Council has obtained an Order giving it power to supply electricity to the Oakfield area of the district.

Newport (Mon.).—Deferred Payment System.—The Corporation has decided, at the request of house-owners, to wire houses on the deferred-payment system.

New Zealand.—Taurang.—According to *The Commonwealth Engineer*, the engineer to the Borough Council has prepared a report on a further extension of the electricity supply at an estimated cost of £75,000. The proposal is to supplement the Omanawa falls plant with another station on the Wairoa river, having an ultimate capacity of 3,500 h.p.

Rochdale.—Loan Sanctioned.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £27,294 for mains and services.

Skipton.—Suspension of Sinking Fund.—The Urban Council is applying to the Electricity Commissioners for sanction to suspend sinking fund contributions for a period of five years.

Special Electricity Orders.—Confirmation.—The following Special Orders made by the Electricity Commissioners have been confirmed by the Minister of Transport:—Caerphilly; Newport (Mon.) (Extension).

Stockton-on-Tees.—Change of System.—The Town Council is adopting the a.c. system for supplying large consumers, and it is intended eventually to change over the whole system to a.c.

Walsall.—Year's Working.—The accounts of the municipal electricity supply undertaking (manager: Mr. H. A. Howie) for the year ended March 31st last record a total revenue from all sources of £84,234, as compared with £96,062 in the previous year. The working expenditure was £58,665, as against £74,379, leaving a gross surplus of £25,569 (£21,683). After the payment of capital charges, &c., a sum of £1,110 was carried to appropriation account; in the previous year the equivalent figure was £1,614. The energy sold decreased from the "record" attained in 1920-21 of 8,397,868 to 8,095,885 units; the maximum simultaneous load, however, rose from 3,600 to 4,050 kW.

Winchcombe.—Water-power Scheme.—A company has been formed for the purpose of providing electricity for the town. Power will be obtained by placing a turbine in the river Isbourne, supplemented by a gas or oil engine. The estimated cost of the scheme is £4,000.

Wimbledon.—Loan.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to borrow £25,000 for the installation of a new 3,000-kW turbo-alternator.

TRAMWAY AND RAILWAY NOTES.

Australia.—Electric Tramcar Requirements of Melbourne.—The Melbourne and Metropolitan Tramways Board (673, Bourke Street, Melbourne) has decided that its future rolling stock will be constructed partly in the Board's own workshops and partly by contract. It is anticipated that in order to provide for new services and for the conversion of the cable tramways, additions will have to be made to the rolling stock at the rate of between 50 and 60 cars annually for several years. Provision will be made in the new workshops for constructing and equipping up to 30 of these cars, and tenders will be invited periodically for the balance. It is probable that the Board will invite tenders within the next few months for the construction of about 60 single-truck electric tramcars—delivery to be spread over two years. The attention of car-building firms to this policy is invited.

China.—Kowloon.—The Government has sanctioned the construction of tramways in the town. About eight miles of track will be laid at first. It is anticipated that eventually from 20 to 30 miles of track will be put down.

London.—Underground Railways.—Twenty years ago 84 trains served Ealing daily. The new services now provided by the District Railway and Central London Railway extension provide Ealing Broadway with no less than 228 trains direct to and from the City and West End. The new extension line of the Central London Railway has brought considerable relief to the District Railway during the evening peak traffic period, as it is beginning to be discovered that the Central London route is quicker, though the fares by either route are the same.

Underground Train Derailed.—Traffic on the District Railway was suspended between Whitechapel and Aldgate last Monday night owing to the derailment of a train running from Whitechapel to Ealing. The line was cleared early the next morning.

L.C.C. AND THE BEXLEY TRAMWAYS.—The L.C.C.'s existing "through-running" agreement with the Bexley Urban District Council expired on July 25th, and the L.C.C. has six months in which to decide upon the purchase of the Bexley system. In the meantime a temporary arrangement has been made to ensure the continuance of through-running.

ACCIDENTS.—A crowded tramcar overturned on July 21st on a hill near the Welsh Harp, Hendon, and 30 passengers were injured, several seriously. It appears that the car was following a steam lorry and ran into it, but it is not clear whether collision between the vehicles occurred before or after the derailment of the tramcar. The driver of the latter stated that one of the men on the lorry put out his hand as if to indicate that the lorry was turning, and he (the driver) immediately applied his brakes, causing the car to leave the rails. The men on the lorry denied that either of them put out his hand.

A tramcar left the rails at Highbury Corner on July 24th and ran into another car. The runaway car was carrying a number of passengers, but only one was injured.

Shipley.—TRACK RENEWALS.—The Bradford Corporation has entered into an agreement with the District Council for the reconstruction of the Nab Wood section of the Bradford city tramways, which comes within the Council's area. The Council will pay the cost of the renewals and the Corporation will pay increased rent for the use of the track and undertake repairs and maintenance of the tramway.

St. Helens.—YEAR'S WORKING.—The accounts of the municipal tramway undertaking (manager: Mr. L. C. F. Bellamy) for the year ended March 31st last show a total income from all sources of £89,772, as compared with £109,813 in the previous year. Working expenses totalled £66,332, as against £77,930, leaving a gross profit of £23,440 (£31,883). The result, after payment of capital charges, was a net profit of £12,889, comparing with a profit of £45,546 in the previous year. The number of passengers carried fell from 11,037,318 to 8,600,917, and the car-mileage from 1,002,861 to 841,307.

TELEGRAPH AND TELEPHONE NOTES.

China.—WIRELESS TELEPHONY.—A system enabling telephone subscribers of Peking and Tientsin to talk to each other by wireless from their house or office telephones, the conversation taking place over wire lines to the central office and then by wireless between the two cities—a distance of over 80 miles—has been installed by the China Electric Co., and successful tests made. The equipment is the product of an American company. It is believed that this is the longest wireless telephone service open to public use in the world.—*Eastern Engineering.*

Holland.—WIRELESS BROADCASTING.—The broadcasting of wireless messages from the Dutch station at The Hague was about to be discontinued owing to the lack of funds. The *Daily Mail*, of London, has, however, entered into an arrangement with the Nederlands Radio-industrie whereby the broadcasting will not only be maintained, but will be developed on wider lines. Transmission will take place under the new arrangement every Thursday and Sunday between 7 and 8 p.m. (summer time); the range is to be extended from 500 to 2,000 miles, the power being 1,500 watts and the wave-length 1,050 metres. The call sign of The Hague station is "P. C. G. G."

No fewer than 88 business firms and private people have arranged to repeat the messages and music received by means of "loud speakers" in London and the provinces for the benefit of those who do not possess receiving apparatus of their own.

Indo-China.—NEW WIRELESS STATION.—The Compagnie Générale de Télégraphie sans Fil is building a big wireless station at Phuto, near Saigon. The station will be started in September. It will communicate directly with the stations at Sainte Assise and Tananarise. The energy needed will be supplied by the Energie Electrique de l'Indo-Chine, which company is now building near Saigon a generating station of 3,000-kW capacity.—*Eastern Engineering.*

South Africa.—WIRELESS TELEGRAPHY.—General Smuts made a statement on the wireless position in the Union House of Assembly on July 19th. The Government was, the Premier said, in possession of three schemes, namely, Marconi's, Elwell's, and the British Post Office's. The Government, General Smuts concluded, had not yet taken a final decision, but at present the arguments were strongly in favour of the Marconi offer.—*Morning Post.*

Sweden.—OPERATORS' STRIKE.—The girl telephone operators at Stockholm and Gothenburg struck work on July 21st, owing to the refusal of the Telegraph and Telephone Board to accept the girls' demands for a joint wage agreement. In Stockholm about 2,000 girls are involved, and the local service is practically paralysed, but the inter-urban traffic is not affected.

A later message says that the strike of the girl operators continues, but has failed in its purpose, as owing to the assistance rendered by volunteers, the service is being carried on in an almost normal manner.—*Reuter's Trade Service* (Stockholm).

Switzerland.—LONG-DISTANCE TELEPHONY.—*The Times* Geneva correspondent states that a new direct telephone line has been established between Zermatt and Brig. The trials have been satisfactory, and it will be possible to telephone every day from Zermatt to London after 6 p.m.

The Telephone Service.—NEW AUTOMATIC EXCHANGE.—The new automatic telephone exchange at Fleetwood was opened on July 15th. It is conducted on the relay system.—*Daily Dispatch.*

UNDERGROUND CABLES.—The work of laying underground telephone cables from Newcastle northwards to Catcleugh, where a junction will be made with the Scottish section, was begun on July 20th; it will cost £500,000.—*The Times.*

U.S.A.—WIRELESS BROADCASTING.—New York City is to have its own station, for which the sum of £10,000 has been allocated. The aerial is to be erected on the roof of the Municipal Building, and the installation is to be begun almost immediately. This is an enterprise which will doubtless be imitated by other municipalities, and suggests one way of solving the broadcasting problem.—*Daily Mail.*

Wireless Telegraphy.—UNDERGROUND TRANSMISSION.—The use wireless might be put to in coal mines was demonstrated in the Blue John Mine, Castleton, Derbyshire, on July 16th by members of the Sheffield Wireless Society. From a depth of about 300 ft. they succeeded in sending a message to Hope, about three miles away.—*Daily Mail.*

BROADCASTING.—The *Daily Mail* announces that the P.M.G. met representatives of the wireless companies on July 25th to discuss with them broadcasting schemes, the Bill now before Parliament, and the restriction of the importation of foreign receiving sets. The companies interested are divided into two groups, and are, it is said, to receive half the revenue from licences for receiving sets which the Post Office issues at 10s. each.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.—MELBOURNE.—October 17th. Postmaster-General's Department. Automatic c.b. telephone equipment, with all associated equipment, including material for use at subscribers' premises. (Sched. 39 and 40.) (July 7th.)

September 27th. Telephone apparatus and parts. (Sched. 561.) (July 14th.)

BRISBANE.—September 20th. Postmaster-General's Department. Supply and delivery of switchboard apparatus and parts. (Sched. No. 559.)*

VICTORIAN ELECTRICITY COMMISSION.—Ten surface feed-water heaters; 6 surface vapour condensers; 12 feed-water evaporators. Specifications £2 2s. Particulars from Agent-General for Victoria, Melbourne Place, Strand, W.C.2.

September 13th. Tramways Board. Twenty-seven straight air-brake equipments for single-truck tramcars.—*Reuter's Trade Service* (Melbourne).

Belgium.—BRUSSELS.—August 2nd. Supply and installation of rotary converters, switchboards, and other accessories for Grand-Saint-Pierre, Alost-Nord, and Denderleeun. M. Foulon, Administrateur des Voies et Travaux, 17, Rue de Louvain, Brussels.*

August 8th. Military Sanatorium, Marchin. Internal-combustion engine for the electricity generating plant. Commandant des Batiments Militaires de Liége-Rive Droite, 22, Rue des Bonnes Villes, Liége.

Bishop's Castle.—August 5th. Installation of electric lighting in the Parish Church. (July 21st.)

Bulgaria.—August 5th. State Railways. Electric hand-drilling machine and spare parts. Direction Générale des Chemins de Fer Bulgars, Sofia. Further particulars may be obtained from Mr. Dempster, Room 50, Department of Overseas Trade, 35, Queen Street, S.W.1.

Edinburgh.—August 3rd.* Parish Council. Various works (including electrical) at Seafield Poorhouse, Leith. Schedules from Mr. J. M. Johnston, architect, 47, Charlotte Street, Leith. Tenders to Mr. R. T. French, Parish Council Chambers.

August 4th. District Board of Control. Repairs and renewals (including electrical work) at Bangour Village Asylum, after military occupation. Specifications and schedule from Mr. James D. Gibson, surveyor, 60, Frederick Street, Edinburgh. Tenders to Mr. R. T. French, clerk, Board of Control, Castle Terrace, Edinburgh.

France.—PARIS.—August 2nd. Two electrically-driven travelling bridges for the sub-stations of St. Germain-en-Laye and Chatou. Service Electrique, 43, Rue de Rome, Paris.

CALAIS.—Municipal Authorities. Installation of heating by low-pressure steam or water at the new Hôtel de Ville. Particulars from the Mairie, Service des Bâtiments Municipaux, or the architect in charge of the works, 10, Quai de l'Escaut, Calais.—*Reuter's Trade Service* (Paris).

Horsham.—July 31st. Urban District Council. Cables. (July 21st.)

Holland. — RAUWERDERHEM. — Low-pressure network and house connections. Specifications (Gld. 12.50) from the office of the Provincinal Electriciteitsbedrijf in Friesland, Emmakade, N.Z., 57, Leeuwarden.

Manchester. — August 8th. Tramways Department. Supply of permanent-way special track work. Specifications and forms of tender from Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester. (Deposit £1 1s., returnable.)

New Zealand.—October 24th. Mangahao Power Scheme. Copper wire. November 21st. Battery booster-transformer. Specifications may be obtained from the office of the High Commissioner.—*Reuter's Trade Service* (Wellington).

October 3rd. Mangahao Power Scheme. Power-house and sub-station transformers; travelling electric cranes; ventilating fans; goods lift; and 110,000-V insulators.*

Oxford.—August 15th. Oxford Electric Co., Ltd. One 1,000-kW turbo-alternator and condensing plant; and one 500-kW conversion plant (3,000 V, 3-phase, to 1,100 V, d.c.), complete with switchgear. (July 21st.)

Plymouth.—August 4th. Electricity Department. Transporter runway travelling trolley hoist. (July 14th.)

Rhondda.—Urban District Council. Two 3-in. and two 6-in. vertical-spindle centrifugal pumps, together with electric motors. Also two cast-iron tanks in connection with the pumps. This does not include work of putting in position. Specifications, plans, and forms of tender (deposit of £1 1s.) from Mr. E. Taylor, engineer and surveyor, Rhondda Urban District Council Offices, Pentre, Rhondda.

South Africa.—GRAHAMSTOWN.—September 1st. Electric lighting plant and equipment, comprising steel poles, overhead wiring, house services, fuses, transformer switches, meters, street lamps, &c. Consulting engineer: Prof. W. Buchanan, 75, Louis Botha Avenue, Houghton Estate, Johannesburg.*

Tasmania.—HOBART.—City Council. 750-kW rotary converter and transformer and 550-volt, d.c. switchboard panel. Tenders are returnable at Hobart on October 2nd next, and particulars, which have been posted, are due to arrive at the office of the Agent-General for Tasmania, Australia House, Strand, London, W.C.2, about the middle of August.

Warrington.—August 14th. Electricity and Tramways Committee. High and low-pressure paper and lead-covered cable, and earthenware conduits. (See this issue.)

Wimbledon.—August 31st. Electricity Committee. One 3,000-kW turbo-alternator, condensing plant, and accessories. (See this issue.)

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—VICTORIAN RAILWAYS.

Three-phase 440-V motors and auto-starters, 7½ h.p. (£72 each); and 5 h.p. (£56 each).—Sweden and Australia:—Thomas Bros.

Three-phase, 440-V motors, 35 h.p. (£137 each); 3-h.p. (£26 each).—Elder, Smith & Co., Ltd.—*Tenders.*

NEW SOUTH WALES.—Postmaster-General's Department.

30,730 condensers, 2 m.f. (2s. 10½d. each).—British General Electric Co., Ltd.

Switchboard cable: 4,006 ft. 51-pair (£660); 2,896 ft. 21-pair (£222); 7,206 ft. 16-pair (£456).—Automatic Telephones (Australasia), Ltd.—*Tenders.*

Bradford.—Electricity Committee.

Supply and erection of a steel roof over the ash hopper at No. 4 boiler house, Valley Road station; and the supply and erection of steelwork in connection with alterations to the Sunbridge Road sub-station.—Henry Barrett & Sons, Ltd., Bradford.

Tramways Committee.

Supply of 20 tons of cast-iron brake shoes and the purchase of the same quantity of scrap cast-iron brake shoes (£147 10s.).—Pease & Partners, Ltd.

Cardiff.—City Coal Committee.

Supply of 15,400 tons of washed duff and 2,400 tons of washed peas, for the Electricity Department.—Powell Duffryn Co.

Hertfordshire.—County Council.

Electric lighting, bells, and telephones at Ware Park Asylum (£3,894).—Strode & Co.

London.—FULHAM.—Electricity and Lighting Committee. 5,500 yd. of 1 sq. in. h.p. cable:—

New Gutta-Percha Co.	£1,610
Watshams, Ltd.	1,400
Callender's Cable & Construction Co., Ltd.	1,298
Union Cable Co.	1,284
Siemens Bros. & Co., Ltd.	1,270
Western Electric Co., Ltd.	1,265
W. T. Glover & Co., Ltd.	1,265
British Insulated & Helsby Cables, Ltd.	1,254
Johnson & Phillips, Ltd.	1,253
W. T. Henley's Telegraph Works Co., Ltd. (accepted)	**1,237**
Hackbridge Cable Co., Ltd.	1,218
Enfield Ediswan Cable Works, Ltd.	1,202
Pirelli, Ltd.	1,187
Electrical Supplies, Ltd. (Dutch)	1,177

Messrs. Henley's tender was accepted on account of uniformity with the rest of the system and for other reasons.

One 1,500-kW Scott-connected transformer for interchange system:—

Fuller Electrical and Manufacturing Co., Ltd.	£910
British Electric Transformer Co., Ltd. (accepted)	**1,174**
Hackbridge Electric Construction Co., Ltd.	1,206
Ferranti, Ltd.	1,269
English Electric Co., Ltd.	1,280
Brush Electrical Engineering Co., Ltd.	1,282
Johnson & Phillips, Ltd.	1,296
Metropolitan-Vickers Electrical Co., Ltd.	1,346

SHOREDITCH.—Lighting Committee.

One mile 1 sq. in. single l.p. cable (£1,160); 1 mile 640 yd. 1.5 sq. in. single l.p. cable (£1,700 per mile).—Union Cable Co., Ltd.

ST. MARYLEBONE.—Electric Supply Committee. High-pressure steam exhaust and feed-water mains, &c.

Babcock & Wilcox, Ltd. (recommended)	**£1,911**
Stewart & Lloyds, Ltd.	1,914
Aiton & Co., Ltd.	2,244

Leigh (Lancs.).—Electricity Committee.

Supply of slack for six months, ending December 31st next, at 14s. per ton, at Committee's wharf.—John Speakman & Sons, Ltd.

Supply of 1,950 yd. of cable (£516).—Callender's Cable & Construction Co., Ltd.

Supply, &c, of coal elevator and bunkers (£893).—E. Bennis & Co., Ltd.

NOTES.

The Proposed Visit to Gennevilliers Power Station.—At a meeting held last week, the Executive Council of the I.M.E.A. considered the proposal that was put forward at the annual general meeting of the association that a visit to Gennevilliers should be organised, and we were gratified to learn that the Council decided not to embark upon a separate scheme, but to recommend the members of the Association to avail themselves of the excursion which is being arranged by the ELECTRICAL REVIEW. Without doubt, this decision will materially increase the number of our party, and will enable us to proceed at once to draw up a definite programme and complete the arrangements.

The outlines of the provisional scheme are as follows:—To leave London for Paris on September 22nd, visit the 200,000-kW power station at Gennevilliers and other notable engineering works, and return to London on September 25th. An extended tour will be organised for the benefit of those who can spare the time to visit other districts. The excursion is open to all engineers, and others interested in the industry, and readers who contemplate taking part in it are invited to send in their names as early as possible.

The Jubilee of the Eastern Telegraph Companies.—On Monday last, a banquet and fête were held in the gardens of the Royal Botanic Society, to celebrate the fiftieth anniversary of the incorporation of the Eastern Associated Companies. The Duke of York was the principal guest at the banquet, which was presided over by Sir John Denison-Pender, G.B.E., K.C.M.G., chairman of the principal companies forming the Associated group, and there was a large gathering of distinguished guests. The staffs of the companies had already presented to the chairman, in recognition of his life-long services to submarine telegraphy and those associated therewith, a volume containing the signatures of nearly 8,000 subscribers, and they have permanently endowed a bed in St. Bartholomew's Hospital in memory of the chairman's late wife, which was dedicated on July 20th. At the banquet a further presentation was made, consisting of the reproduction in platinum, set with brilliants, of the stars of the distinguished orders to which Sir John belongs.

The gardens were exquisitely illuminated by many thousands of fairy lamps, and marquees provided shelter in case of rain, but fortunately the weather, after a rainy morning, became fair and warm, and the guests were able to roam at will from one attraction to another. The programme included music by the band of the Coldstream Guards and by the Margaret Holloway Ladies' Orchestra, dancing by Mlle. Karsavina (and by the guests), an excellent variety entertainment in an *al fresco* theatre, an open-air kinema, the Margaret Morris dancers, exhibition lawn tennis by artificial light, and performances by a thought-reader, a cartoonist and palmists, as well as clock golf and a magnificent firework display. Refreshments were provided at numerous buffets, and every care was taken to minister to the comfort of the guests. One of the most interesting items, even to the non-technical, was an admirable exhibition of sections of cables, cable-handling apparatus, cable-jointing and repairs, historic documents, and both ancient and modern sending and receiving apparatus, the modern types being in operation. Altogether the function was most enjoyable and successful, nearly 5,000 people being present.

Appointments Vacant.—City electrical engineer and manager for Dundee Corporation (£800—£50—£1,000); shift engineer (£262), for Eccles Corporation; line foreman (£300), for the Government of British Guiana; four switchboard attendants (75s. per week) for Edinburgh Electricity Department; foreman platelayer for Yarmouth Corporation Tramways; and sub-station attendant for Whitechapel. (See our advertisement pages to-day.)

Wireless on Aircraft.—A half-yearly report on the progress of civil aviation—the sixth of the series—covering the winter period from October 1st, 1921, to March 31st, 1922, has been issued by the Air Ministry as a White Paper.

At the suggestion of the Handley Page Co. a system has been introduced at Croydon Aerodrome for locating aircraft by sound and informing pilots of their position in relation to the aerodrome when arriving in bad weather. This system is effective within a radius of about 10 miles from the aerodrome. The officer in charge of the control tower at Croydon determines the direction of the aircraft by means of a sound locator, and informs the pilot by wireless telephony in which sector of a circle surrounding the aerodrome he is flying.

Regulations are to be introduced for the compulsory carriage of wireless apparatus by British passenger and goods aircraft. Meanwhile all British aircraft (with the exception of two small machines) operating on the air routes between England and the Continent under the subsidy scheme, are already equipped with wireless telephone apparatus. The French air transport companies have agreed that all their larger passenger-carrying aircraft on the London-Paris service shall be so equipped by the middle of August this year, and the Dutch authorities are making similar arrangements.

Further experience has been gained in the combination of line and wireless telephony, and experiments have been carried out to ascertain how far telephone calls by passengers *en route* between London and Paris would be utilised. Two private calls were allowed during each flight, but the demand for their use was not sufficient to justify, at present, the permanent adoption of this scheme.

The arrangements mentioned in the last report for opening the English section of the London-Paris route for night flying consist of aerial route lights at Tatsfield Hill and Cranbrook and an automatic illuminated ground sign, which will be situated at Penshurst emergency landing ground. These various lights will operate for a year without attention. In addition, an automatic wind indicator for night flying has been completed at Croydon, while the progress made with searchlights and other apparatus designed to simplify night landing has placed the Croydon and Lympne aerodromes in a position to cope with night services at short notice.

An aerial route light, similar to those used in England, is to be erected in Egypt, and this will make possible the collection of data regarding atmospheric absorption, ranges of lights, and climatic effects necessary for the provision of night flying facilities over desert areas.

The daily Press announces that to facilitate the use of wireless telephony on aircraft, according to a report issued on July 19th by the Directorate of British Civil Aviation, Great Britain, France, and Belgium have prepared a vocabulary of standard phrases in English, French, and Dutch. Each phrase and word is numbered for the benefit of operators unacquainted with languages other than their own. With this code the only parts of a foreign language a pilot or ground wireless operator need know to carry on a conversation are the numerals, the code consisting simply of the figures 1 to 85, each figure representing a phrase dealing with such matters as weather, illness, time, and position. For example, the operator at an air station who hears "70" knows to "Arrange for a doctor." The code number "44" is a request for weather conditions, and "48" conveys the news "The sun is shining."

Industrial Research.—The July report of the British Electrical and Allied Industries Research Association covers the activities of the Association over the last quarter. It has been found advisable to set up two new Committees whose work will co-ordinate that of some of the existing Committees. The first will consider the classification of the heat-resisting properties of electrical materials, and a system of nomenclature and test methods for them; the second will deal with the testing of the electric strength of insulating materials. The programme of the latter Committee also includes research on the testing of sheet materials with disk electrodes, with a view to ascertaining the limitations, best test conditions, and probable errors of the method.

Samples of varnished fabrics are being prepared by co-operating manufacturers under controlled working conditions, with a view to the investigation of the technical problems involved in their improvement. Co-operating paper manufacturers are also devoting special attention to their product for electrical purposes, made to the specifications of properties and test methods set out in the report already published. The working temperature of papers is also receiving attention from the Association. A report on the completed research upon hard composite insulating materials is now available.

Much new work is being done by the Association upon oils for insulating purposes. A report has been prepared giving reasons for the Association's preference for sphere gaps for oil tests. Further research, however, is in hand to determine the relative merits of the horizontal and vertical arrangements of sphere gaps. The experiments upon the improvement and maintenance of electric strength by centrifugal separation of the oils, whilst still incomplete, show the method to hold much promise. Advantage has been taken of the presence in this country of Mr. Evert Norlin, of the Government Testing Institute of Sweden, to ascertain the Continental and American opinion of sludge and tar-value determinations.

Tables and an accompanying report are now in preparation showing the experimental conclusions arrived at concerning the safe loading of British standard cables up to 11,000 volts. A satisfactory method has been found of applying results obtained on single-core cables to three-core cables. Other reports on cables are due shortly. The researches for determining under working conditions the elastic modulus and other physical properties of wires and cables of a variety of metals in ordinary use have been completed. Work on improvements in the construction of wood poles for overhead lines is now in hand.

It is unfortunate that the preparation of experimental apparatus designed for the investigation of switching and arcing phenomena has been delayed by industrial troubles, but pressure-recording apparatus and a continuously operating high-speed camera with an aperture of F 2.6 have been devised. The work on the relief of gaseous explosion pressures (in mining apparatus) through flanged joints has yielded some unexpected results, and the investigations are to be extended to cover other methods of pressure relief.

The National Physical Laboratory has developed apparatus for measuring small losses by current leakage, and by its aid new results for mica have been obtained; certain preliminary work at low voltages has also been done on varnished cloths. Research on this subject has necessitated the development of a wattmeter for use at high voltages, and the Laboratory has obtained satisfactory results with this up to 10,000 volts. For the measurement of dielectric losses at high frequency, the Braun tube is being developed by Prof. MacGregor-Morris with some success.

A Large Motor.—A new reversible electric motor developing 18,000 h.p., built by the Société des Ateliers de Constructions Electriques de Charleroi, and intended for the operation of a large blooming mill, has lately been put in operation at the works of the Société des Forges de la Providence, at Charleroi.

The Use of Small Water Powers.—Numerous widely-scattered small water powers exist in the United States which have remained unutilised up to the present time because of the expense of developing the power, operating the plant and transmitting the energy to a market. These economic obstacles can be removed to a great extent by installing automatic induction-generator stations and tying them in with a larger station or system. Recently a practical application of this suggestion was made by the Tayford Co., Inc., near Lee, Mass., where two induction generator stations are interconnected with the Lee and Pittsfield electric service systems.

A watershed with a total area of about 15 sq. miles is utilised, the two generating plants operating under gross heads of 437 ft. and 68 ft. The high-head station contains three 350-h.p. Pelton waterwheels, coupled to General Electric induction generators, each rated at 300 h.p., 600 r.p.m. (synchronous speed), three-phase, 2,300 volts, 60 cycles. The rotors are of the squirrel-cage type. To guard against a runaway speed in case of lost excitation a governor acts on the deflector of the water jets, limiting the speed to a few per cent. above the synchronous value when the line is de-energised. As a result no severe jolts are caused when the line is re-energised. The necessary exciting current is furnished by synchronous steam-turbine units in the Pittsfield Electric Co.'s Silver Lake plant, which is tied to the Lee asynchronous stations by a trunk line.

The low-head station contains two 200-h.p. turbines directly connected to induction generators.

In normal operation the load on the induction-generator is the only governor desired, and at any time the load being carried determines its speed, so long as the circuit on which it floats is closed. It has been found that with a synchronous speed of 600 r.p.m. and a full-load speed of 585 r.p.m. the motor will generate its full rating at a little below 615 r.p.m.

At synchronous speed and with theoretically no power produced or consumed, about 17.5 amp. excitation current was required. This current increased at a decreasing rate as the machine output grew larger. The power factor therefore increased with the load.

Although provision is made to control and read the load conditions of the low-head station at the high-head plant, there is no co-ordination of operation between these induction-generator stations and the steam station with which they are connected electrically. The steam-station operator can always ascertain if the induction-generator stations are on the line by the exciting current which they draw.

The two induction-generator plants are being successfully operated with two mechanics and a general supervisor, who is called upon when necessary. The total labour cost is $2,500 per year.—*Electrical World*.

Legal.—ELECTRICAL REPAIRING CO. *v.* CLARK.—The plaintiffs, of Lydney, Forest of Dean, brought an action in the Newnham County Court, on July 19th, against E. Clark, of Woolaston, people's warden of the local parish church, to recover £140 18s., being the cost of installing electric light in the church. After the case had been commenced the vicar and the other churchwardens were joined with Mr. Clark as defendants to the action, and eventually the judge referred the claim to an expert to determine what amount he should give judgment for.

Wireless Broadcasting.—The Electrical Contractors' Association (Inc.) is taking a keen interest in wireless broadcasting on behalf of its members. The Association thinks that the business of selling and equipping receiving stations should remain in technical hands if complaints and disappointments are to be avoided. There is at present a strong committee of the Council investigating the whole subject from the electrical contractors' point of view.

The British Association.—The Leeds University Court has decided to confer the honorary degree of Doctor of Science upon a number of eminent foreign scientists who are attending the B.A. meeting at Hull in September next.

British Engineering Standards Association.—The Association held its fourth annual general meeting on July 13th at the Institution of Civil Engineers, when the chairman, Sir Archibald Denny, Bart., presented his annual report and reviewed the position. The meeting was well attended, and the chairman's report again showed great expansion in the work. There are now nearly 2,000 engineers who give their time and experience to this national institution. Last year just under £17,000 was expended, towards which industry in spite of the depression in trade contributed £9,300, the remainder coming from the Government, the India Office, and the Governments of the Dominions overseas. The chairman felt that the Association should not have to live quite so much from hand to mouth, and should be able to build up a small reserve. The Association has issued 72 new and revised specifications during the year, and the sales of the publications have reached 39,000, in addition to a very large number of aircraft specifications distributed on behalf of the Air Ministry. It cannot be too emphatically urged that contributions to this organisation should be considered as a sound business investment, from which an adequate return is expected and indeed obtained.

Electricity on the Farm.—A good deal of interest is being taken just now in the use of electricity on farms and for agricultural purposes generally, and in this connection it is encouraging to note from information supplied by the British Electrical Development Association that the Fife Electric Power Co., Ltd., Dunfermline, of which Mr. J. S. Thompson is the manager, has on its books at the present time the names of some 34 farms, all of which use electricity for lighting; 23 of them also use electricity for power purposes, and 17 use it for domestic uses other than lighting. The company has so far not been able to do anything in the way of electric ploughing and such like operations, but the following list of farms supplied by the company show their average annual consumption of electricity in kWh :—

	Power.	Lighting.	Other Domestic Uses.	Totals.
1	651	322	58	1,031
2	680	519	3,211	4,410
3	83	583	184	850
4	935	658	1,020	2,613
5	249	276	—	525
6	—	367	1,020	1,387
7	1,073	146	216	1,435
8	248	433	—	681
9	673	425	492	1,590
10	—	455	—	455
11	—	72	—	72
12	—	414	—	414
13	2,014	630	3,824	6,468
14	650	294	—	944
15	—	323	—	323
16	—	160	—	160
17	662	368	715	1,745
18	3,256	85	—	3,341
19	—	125	—	125
20	655	622	2,276	3,553
21	425	1,263	865	2,553
22	700	378	—	1,078
23	—	252	—	252
24	723	293	1,124	2,140
25	—	127	135	262
26	56	303	—	359
27	1,405	1,310	—	2,715
28	31	509	555	1,095
29	490	456	190	1,136
30	—	153	117	270
31	407	527	—	934
32	225	231	—	456
33	—	476	—	476
34	675	323	1,394	2,392

Fatality.—An inquest was held at Hartlepool on July 14th on Robert Summers, aged 19, an apprentice fitter, of Francis Street, who was fatally injured at the brass foundry of Messrs. Richardsons, Westgarth & Co. Jonathan Emerson, an apprentice millwright, stated that he and deceased were working on the girders supporting an electric travelling crane. Witness accidentally dropped his hammer and descended to recover it. While he was down Summers walked from the crane platform to the driver's carriage, and shouted to witness to put the switch in. Witness did so, and Summers drove the crane to the stops and back again for a couple of yards. Summers then told him to pull the switch out. Witness did so and shut the doors. He returned to the girder, and had been working about 15 minutes when Summers asked if the switch was off. Witness replied in the affirmative, and deceased thereupon got on top of the cage and seized one of the control wires. A flash ran along the wires towards witness, and there was a crackling noise. Summers slipped off the top of the cage and remained hanging with one hand for a second or so. The wire broke and he fell on to his head.

In reply to questions, Emerson said he was quite confident he pulled out the proper switch, but he could not offer any explanation as to how the switch came to be in afterwards. He said he did not notice anyone about at the time. Andrew McDonald, foreman brass moulder, said that immediately after the accident he noticed that the switch was in. He then pulled it out. The jury returned a verdict of "Accidental death," and suggested stricter supervision over the switches, adding: "We are not sure whether this boy (Emerson) pulled out the wrong switch or someone else interfered with it."

Electric Railway Signal Lamps.—An interesting article in the July issue of the *General Electric Review* describes the development and application of miniature Mazda lamps for railway signal lighting to replace the oil burner in existing signal lanterns. These incandescent lamps will be operated in most cases from battery circuits; and in order to conserve batteries the lamps will be automatically lighted only on the approach of trains and extinguished when the trains have passed. Results obtained from actual installations over several years show that these electric lamps will effect material economy in maintenance and cost of inspection and replacement; and with the development of new designs of lanterns to replace existing oil signal lanterns as they wear out, the useful illumination will be increased from 15 to 60 or 70 per cent. of the total light flux.

A Directional Hot-wire Anemometer.—Mr. A. Bailey describes, in report No. 777, January, 1922, of the Aeronautical Research Committee (C.1 Accessories—Instruments. 78—T. 1,679), a novel form of hot-wire anemometer, which has been devised to assist in an investigation on ventilation problems, and has been found very useful in determining both the speed and direction of movement of streams of air. The instrument will measure air speeds between about 6 in./sec. and 15 to 20 ft./sec., but this range may be altered to include higher speeds. The principle of the instrument, so far as the measurement of air speed is concerned, is the usual one, *i.e.*, a piece of platinum wire is heated by passing an electric current through it, and the resistance of the wire is measured by means of a Wheatstone bridge. In order to obtain direction, advantage was taken of the shielding effect of a circular rod placed in an air stream parallel to the hot platinum wire, and in the same plane, and mounted in such a manner that it could be moved across the field in front of the hot wire. The result proved very satisfactory. Of the two principal methods used in hot-wire anemometry, that in which a constant current is passed through the wire and the resistance of the wire determined by the out-of-balance deflection of the galvanometer is the one which has been used for the present experiments. The instrument was calibrated for both speed and direction in the 3-ft. wind channel at the National Physical Laboratory. There is a very sharp rise in the temperature of the hot wire when the manganin wire passes in front of it and the direction of the moving stream of air can be determined to one or two degrees. In a steady wind, such as is found in the wind channels, it would not be necessary to take a large number of readings, as the reading of the galvanometer is very steady and the point of maximum temperature can easily be determined, but in general use the wind would not be so steady, and the best method of using the instrument is to obtain curves, taking the mean reading of the moving galvanometer needle at each position: the horizontal portion of the curve then gives the speed of the wind and the position of the peak gives the direction. The instrument as described is suitable for speeds up to about 15 or 20 ft./sec., but it is possible that it can be easily adapted for higher speeds by covering the anemometer head with a perforated tube. Further experiments have been made in this direction, but owing to the pressure of other work, there has not been time to carry the investigation far. The tube does not interfere with the sense of direction of the instrument.

Electric Vehicle Committee of Great Britain.—At the meeting of the Electric Vehicle Committee of Great Britain, held at the Institution of Electrical Engineers on July 13th, Mr. J. A. Priestley, cleansing superintendent of the Sheffield Corporation, was elected chairman of the Committee, and Mr. W. H. L. Watson, of Electricars, Ltd., and Mr. W. Worby Beaumont were elected vice-chairmen. Mr. E. E. Hoadley was re-elected hon. secretary, and Mr. J. Christie hon. treasurer. A cordial vote of thanks was passed to Mr. F. Ayton, the retiring chairman, for his long services on behalf of the Committee.

Result of Engineers' Ballot.—The pooled vote of the engineering trade unions upon the question of a wage reduction of 16s. 6d. per week in three instalments showed a majority of 26,963 against acceptance, the actual figures being 43,937 for and 70,900 against the proposal. The position was to be discussed yesterday (Thursday) afternoon by representatives of the unions and the employers. (As stated in our last issue, the membership of the A.E.U. alone is 394,000, and five other unions participated in the ballot.)

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Herts. County Council has appointed Mr. JAMES DOBBIN, of Hertford, as temporary electrical engineer at the Ware Park Sanatorium, to superintend the installation of the electric lighting, steam-heating plant, &c.

Mr. ALBERT TAYLOR, for 18 years on the Mansfield Corporation electricity staff, who is leaving to take up a position in Australia, has been presented by his colleagues with a silver cigarette case.

Mr. W. J. LLEWELLYN, who is retiring on pension from the position of engineering inspector for the Newport area of the Post Office, after being 46 years in the service, was presented by his colleagues with a timepiece equipped with Westminster chimes. Mr. Llewellyn has been closely identified with the development of the telephone service in South Wales, and was also associated with early experiments in wireless.

Dr. F. G. COTTRELL has been appointed director of the U.S.A. Fixed Nitrogen Research Laboratory in succession to Dr. R. C. Tolman.

Under the arrangement now existing between the Falkirk Iron Co., Ltd., and the Hotpoint Electric Appliance Co., Ltd., Mr. F. H. HOWELL, who has been the electrical representative for the Falkirk Iron Co., Ltd., has been appointed London sales manager for the Hotpoint Co. His address is 21, Berners Street, W., from whence he will control the sales of both companies' electric cooking and heating appliances.

The St. Marylebone Electricity Supply Committee recommends that the salaries of the principal officers of the department be increased as follows:—Mr. C. H. Smyth, chief engineer, to £1,500; Mr. F. B. Leonard, chief assistant engineer, to £900; Mr. F. Selley, mains and sales engineer, to £750; and Mr. W. Harper, chief clerk and accountant, to £700. These increases will put the officials on a level with those of similar undertakings.

NEW COMPANIES REGISTERED.

Electrical Instruments (Leeds), Ltd. (183,192).—Private company. Registered July 18th. Capital, £1,500 in £1 shares. To acquire the business of electrical instrument makers carried on by A. L. Hill, C. F. Randles and G. E. T. Randles at Cross Fountain Street, Guildford Street, Leeds, as the "Electrical Instrument and Magneto Co." The permanent directors are: A. L. Hill, Sheepfield Cottage, Stockeld, Wetherby; C. F. Randles, Pool Bank, near Leeds (manager, Crossley Gas Engines, Leeds office); G. E. T. Randles, "The Bungalow," Lysham House, Lower Wortley, Leeds. Secretary: G. E. T. Randles. Registered office: 5, Cross Fountain Street, Leeds.

Wireless Telephones, Ltd. (183,182).—Private company. Registered July 17th. Capital, £1,000 in £1 shares. To carry on the business of advisers, experts, consultants, contractors and the like in connection with wireless telephony and telegraphy, and to undertake and carry out partial or entire installations, &c. The permanent directors are: F. Duxbury (chairman), "Whyte Garth," Curzon Avenue, Birstall, Leicester; T. A. Robins, 351, Humberstone Road, Leicester. Qualification: 10 shares. Registered office: 8, King Street, Leicester.

Sound Amplifiers, Ltd. (183,128).—Private company. Registered July 14th. Capital, £2,500 in £1 shares. To take over all the interest of A. Marr in inventions for improvements relating to the concentration and amplification of sound waves and the like, to acquire from him the patent rights of the said inventions for Great Britain and Ireland and any British Colony or Dependency and the Channel Islands and the Isle of Man, and to carry on the business of engineering and electrical specialists, electrical apparatus and appliance manufacturers, &c. The permanent directors are: A. Marr, 23, Reynell Road, Longsight, Manchester; J. C. Crofts, Willowcroft, Trafford Road, Alderley Edge; E. B. Rowley, 7, Manley Road, Whalley Range, Manchester; R. S. Ashworth, Bank House, Bury. Qualification: £250. Acting secretary; H. Ison. Registered office: 37, Cross Street, Manchester.

Claremont Johnson & Co., Ltd. (183,228).—Private company. Registered July 19th. Capital, £4,000 in £1 shares. Importers and manufacturers of electrical appliances, &c., and to adopt an agreement with G. W. Johnson and L. Cohen. The first directors are: D. Cohen (permanent chairman), 67, High Street, Stoke Newington, N.16; G. W. Johnson, 99, Maidstone Road, New Southgate, N.11; L. Cohen, 19, Brooke Road, Stoke Newington, N.; W. J. Hodge, 72, Sandford Road, Bromley, Kent. Qualification: £200. Remuneration: £30 each per annum (chairman, £60). Registered by G. Fletcher Jones, 12, Old Jewry Chambers, E.C.

Ashley Wireless Telephone Co., Ltd. (183,106)—Registered July 14th. Capital, £50,000 in £1 shares. To take over the business of wireless telephone and telegraph engineers and manufacturers of wireless apparatus lately carried on by W. A. Brooke and W. A. McKillop at 69, Renshaw Street, Liverpool, and at Cable Street Works, Liverpool, as "Ashley Radio." The minimum cash subscription is seven shares. The first directors are: E. C. Marston, 42, Kennedy Street, Manchester (shipping agent and director E. C. Marston & Co., Ltd.); W. A. McKillop, 14, Asser Road, Clubmoor, Liverpool, electrical engineer; W. A. Brooke, 14, Asser Road, Clubmoor, Liverpool, wireless engineer; D. Walker, Dorcote, Cressington, near Liverpool, manufacturer's agent. Secretary: F. E. Thornley. Registered office: 69, Renshaw Street, Liverpool.

Midland Motor Factors, Ltd. (183,151).—Private company. Registered July 15th. Capital, £5,000 in £1 shares. To carry on the business of electricians, mechanical engineers, suppliers of electricity, manufacturers of and dealers in electric, petrol, and steam motor cars, iron and brass founders, &c. The first directors are: T. H. Wathes, The Oaks, West Hill Road, Leicester, electrician; W. C. Turner, 70, Upperton Road, Leicester, electrician (both directors of T. H. Wathes, Ltd.). Qualification: £250. Remuneration as fixed by the company. Registered office: Adjoining Barclay's Bank Buildings, 17, High Cross Street, Leicester.

Broadheath and District Manufacturers' Association, Ltd. (183,226).—Registered July 19th as a company limited by guarantee, and not having a share capital. To promote, develop and protect the interests of the trades in which the members for the time being are concerned in all their various branches; to assist members with advice and legal assistance when required with regard to assessment of their works for Parliamentary, parochial and other taxation, and to contest principles upon which such taxation is levied or attempted to be levied, &c. The first directors are: J. R. C. Kearns, Orrish Meres, Brooklands (managing director, H. W. Kearns & Co., Ltd.); J. P. Wood, Stratheyre, Manchester Road, West Timperley (director, Castleton Steam Packing Co., Ltd.); K. Ord-Mackenzie, Fitlundie, Albert Square, Bowden (director, Charles S. Madan & Co., Ltd.); T. E. Leigh, Krahnholm, Hale Road, Hale (director, Cook & Co., Manchester, Ltd.); G. E. Rigby, Arnside, Ansdell, Lytham, St. Annes (director, Ruby Cycle Co., Ltd.); H. Naylor, Carradale, Heald Road, Bowden (governing director, Record Electrical Co., Ltd.). Hon. secretary and treasurer: K. Ord-Mackenzie. Registered office: Vorte Works, Broadheath, near Manchester.

General Wireless, Ltd. (183,261).—Private company. Registered July 20th. Capital, £100 in £1 shares. To sell, purchase, let on hire, manufacture, fit, install and maintain wireless telegraphic and telephonic apparatus, &c. The subscribers (each with one share) are: P. J. Ashton, 72, High Street, Bromley, Kent, secretary; R. Sawford, 86, Audley Road, Hendon, N.W.4, motor engineer. The subscribers are to appoint the first directors. Solicitors: Mye, Moreton & Co., 12, Serjeants' Inn, Temple, E.C.4.

R. J. Richardson & Co. (London), Ltd. (183,124).—Private company. Registered July 14th. Capital, £3,000 in £1 shares. To adopt an agreement with R. J. Richardson and to carry on the business of manufacturers of and dealers in vulcanised fibre, ebonite and insulating materials, mechanical, electrical and general engineers, &c. The first directors are: R. J. Richardson, The Homestead, Heming Road, Edgware; H. Griffiths, 37, Royston Avenue, South Chingford, Essex; J. E. Lines, 62, Chandos Crescent, Edgware. Secretary: W. T. Asher. Registered office: 10, Northampton Square, E.C.1.

Radio Equipment Co., Ltd. (183,242).—Private company. Registered July 15th. Capital, £100 in £1 shares. To carry on the business of manufacturers, importers and exporters of and dealers in all kinds of wireless, radio and electrical appliances, &c. The subscribers (each with one share) are: W. J. Hawkins, 329, High Holborn, W.C.1, merchant; P. J. White, 329, High Holborn, W.C.1, merchant. W. J. Hawkins signs as director and secretary. No qualification necessary. Registered office: 427, Bank Chambers, High Holborn, W.C.

Radiophones, Ltd. (183,125).—Private company. Registered July 14th. Capital, £5,000 in £1 shares. To carry on the business of electricians, manufacturers of generators, accumulators, suppliers and distributors of electricity and electrical energy for lighting, heating, telegraphic and telephonic communications, traction, motive power or other purposes, &c. The subscribers (each with one share) are: F. S. Bennett, Granville Chambers, Granville Place, W.1, engineer; A. N. Mobbs, Gorse Hill, Hook Heath, Woking, company director. The subscribers are to appoint the first directors. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, W.C.

Stockport Lamp Co., Ltd. (183,305).—Private company. Registered July 21st. Capital, £1,000 in £1 shares. To carry on the business of mechanical and electrical engineers, manufacturers of electrical accessories, &c. The first directors are: J. Higginson, Buckland, Washway Road, Ashton-on-Mersey, Cheshire; J. A. Charlton, Woodlands, Wilbraham Road, Alexandra Park, Manchester. Qualification: 10 shares. Registered office: Bank of England Chambers, Tib Lane, Manchester.

Semple, Ltd. (12,301).—Private company. Registered in Edinburgh July 14th. Capital, £700 in 650 ordinary shares of £1 each and 700 deferred of 1s. each. To carry on the business of engineers (consulting, mechanical, electrical, marine, automobile, heating, ventilating and general), ironmongers, &c. The subscribers (each with one share) are: P. S. Reed, 76, St. Andrew's Drive, Pollockshields, Glasgow, engineer; D. R. MacDonald, Cumbrae View, Millport, engineer. R. Semple is managing director. Qualification: 50 shares. Registered office: 101, St. Vincent Street, Glasgow.

Andrew Hutcheson, Ltd. (12,302).—Private company. Registered in Edinburgh July 14th. Capital, £10,000 in £1 shares. To carry on the business of electrical engineers, contractors, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus and machinery, fittings, &c. The first directors are: A. Hutcheson, 104, West Campbell Street, Glasgow, electrical engineer; J. Hutcheson, 104, West Campbell Street, Glasgow, electrical engineer; J. Grindlay, Glasgow, electrical engineer; J. Y. Hutcheson, Glasgow, electrical engineer; J. Mare, Glasgow, chartered accountant; J. S. Paul, Glasgow, solicitor. Qualification: 100 shares. Registered office: 104, West Campbell Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Calcutta Electric Supply Corporation, Ltd. (50,882).—Return dated May 23rd, 1922. Capital, £3,000,000 in 1,645,000 ordinary and 1,355,000 preference shares of £1 each. £800,000 ordinary and 605,000 preference shares taken up. £1,350,000 paid on 800,000 ordinary and 550,000 preference. £55,000 considered as paid on 55,000 preference. Mortgages and charges at date of return, £559,100; since registered, trust deed to secure £500,000 second debentures, dated June 26th, 1922. A trust deed dated June 26th, 1922, to secure £500,000 second debentures, has been registered. The deed constitutes a specific charge on various properties in India, and a floating charge on the company's general assets, including uncalled capital, subject to a trust deed dated November 17th, 1920. The trustees for the debenture holders are the Metropolitan Trust Co., Ltd., of Gresham House, Old Broad Street, E.C. The debentures are being issued at 96 per cent. No other commission or discount is being paid or given.

Hardy & Nash, Ltd.—Mortgage on land and premises in Cromer dated July 8th, 1922, to secure £1,000. Holder: H. Bullen, Cromer.

Teignmouth Electric Lighting Co., Ltd.—Particulars of £3,500 debentures authorised July 6th, 1922; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

E.S. Co., Ltd.—Particulars of £20,000 debentures authorised July 12th, 1922; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital subject to first mortgage debentures for £12,000.

Porlock and District Electric Supply Co., Ltd.—Second debenture dated June 30th, 1922, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: O. L. C. Healey, New Place, Porlock, Somerset.

Associated Electric Traders, Ltd.—Particulars of £6,000 debentures authorised May 22nd, 1922; present issue £2,500, charged on the company's undertaking and property, present and future, including uncalled capital.

Accumulators of Woking, Ltd.—Debenture dated July 7th, 1922, to secure £10,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: L. C. Rawlence, 40, Sackville Street, Piccadilly, W.

National Electric Construction Co., Ltd. (53,364).—Capital, £125,000 in 10s. shares. Return dated May 11th, 1922. 170,000 shares issued. £75,574 10s. paid. £9,425 10s. considered as paid. Mortgages and charges, £75,000.

Jarrow and District Electric Traction Co., Ltd. (78,680).—Capital, £60,000 in £1 shares. Return dated May 10th, 1922. 59,934 shares issued. £49,945 paid. £9,989 considered as paid. Mortgages and charges, £1,700.

Chiswick Electricity Supply Corporation, Ltd. (38,854).—Return dated May 4th, 1922. Capital, £100,000 in £1 shares. 62,800 shares taken up. £62,800 paid. Mortgages and charges, £74,310.

Rhondda Tramways Electric Supply Co., Ltd. (94,470).—Return dated June 1st, 1922. Capital, £100 in £1 shares. Seven shares taken up. £7 paid. Mortgages and charges, £54,000.

Bastian Meter Co., Ltd.—Return dated April 26th, 1922. Capital, £20,235 10s. in 68,942 ordinary shares of 5s. each and 3,000 preference shares of £1 each. 2,011 preference and 39,672 ordinary shares taken up. £3,082 10s. paid (including £3 10s. paid on forfeited shares) on 4,272 ordinary and 2,011 preference. £8,850 considered as paid on the remaining 35,400 ordinary. Mortgages and charges, nil.

Urban Electric Supply Co., Ltd. (57,986).—Capital, £640,000 in 80,000 ordinary shares of £3 each, 50,000 cumulative preference shares of £5 each, and 150,000 preference shares of £1 each. Return dated April 11th, 1922. 80,000 ordinary and 50,000 cumulative preference shares issued. £490,000 paid. Mortgages and charges, £424,947.

Cleveland and Durham Electric Power Co., Ltd. (89,539).—Capital, £700,000 in £1 shares (350,000 preference and 350,000 ordinary). Return dated May 24th, 1922. 333,705 preference and 157,600 ordinary taken up. £411,003 paid on 331,935 preference and 79,068 ordinary. £80,302 considered as paid on 1,770 preference and 78,532 ordinary. Mortgages and charges, £384,900.

R. J. Rodd, Ltd.—Deposit on July 11th, 1922, of deeds of freehold land and premises at Walton-on-Thames, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Allies Electric Lamp Repairing Co., Ltd. (138,125).—Return dated January 13th, 1922. Capital, £55,000 in £1 shares. 32,425 shares taken up and paid for in full. Mortgages and charges, £6 000.

Farad Electrical Co., Ltd.—W. C. Whitehead, of 27, Oberstein Road, Clapham Junction, S.W., ceased to act as receiver or manager on June 24th, 1922.

CITY NOTES.

Anglo-Portuguese Telephone Co., Ltd.

The report for the year ended December 31st, 1921, states that the average rate of exchange for the year (taken on the last day of each month)) was 6¼d. per escudo, in comparison with 12¾d. for 1920. The rate prevailing at the close of the year was 5 7/32d., as against 6¼d. at the end of 1920. The floating assets and liabilities in Portugal at the close of the year have been converted into sterling at the rate of 5 7/32d. per escudo. The capital expenditure for the year amounted to £81,534, in comparison with £121,367 for 1920. The item of "New capital issues expenses £19,930," appearing in the last balance sheet, has been written off against the reserve fund of £25,000. To the balance of this fund there has been added the exchange fluctuation fund of £10,000, and the general reserve now stands at £15,070. The profit and loss account shows a gross income of £70,695, and an expenditure of £50,410, leaving a gross profit of £20,285, as against £6,024 for 1920. In neither case has any provision been made for depreciation. After payment of income tax, £3,282, and providing for debenture interest and sinking fund, £6,850, the amount for disposal (less £213 debit balance brought forward) is £9,940, which it is proposed to carry forward. The year's revenue receipts and expenses have been converted into sterling at the monthly average of 6¼d. per escudo. Expressed in currency—the true measure of comparison—the gross income from subscriptions, sales, &c., was Es. 2,757,466 (against Es. 797,832 in 1920), the expenses in Portugal were Es. 1,583,771 (against Es. 737,074), and the trading profits Es. 1,173,695 (against Es. 60,758). The following table shows the extreme fluctuations in the sterling value of the escudo (nominally 53⅓d.) in each of the last eight years; also the yearly average (taking the price on the last day of each month) and the rate prevailing on the last day of the year:—

	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.
Highest	47⅞	38	36	32¾	34⅜	35⅝	19½	8¾
Lowest	33	33½	30¼	29 11/16	28	19	5¾	4⅜
Average	42 7/8	35⅛	34 1/32	31 7/16	30⅜	28 13/16	12⅜	6⅛
At December 31st ...	36⅛	34 1/16	31 7/16	30⅛	34⅜	20d.	6⅜	5 29/32

In addition to the increase in the company's rates authorised by the Portuguese Government on February 21st, 1921, and reported to the shareholders at the last general meeting, a further substantial increase was authorised by Decree dated June 29th, 1922. Unfortunately the advantages of the increased subscription rates are largely offset by further increases in wages. The company's relations with the Government and the public have been maintained on a friendly footing. Unfortunately, however, the political and industrial conditions in Portugal do not show any improvement. Captain Hubert Feilden Jackson, who had been a director since 1899, has, for personal reasons, been obliged to resign his seat on the board. To fill the vacancy thus created Mr. P. B. Lawson has been appointed a director.

English Electric Co., of Australia, Ltd.

The report submitted at the annual meeting held at Sydney on June 15th showed that expenditure on the new workshops at Clyde was almost completed. "Unfortunately these new workshops have been built and equipped at the top of a boom in prices, but this will not affect the earning capacity of a plant which is superior to anything in the Southern Hemisphere." The company has a considerable amount of work in hand. Some large contracts, carrying profits, should be completed during the current year. The investments, with the exception of a small holding in Automatic Telephones (Australasia), Ltd., represent the company's shareholdings in Standard-Waygood, Ltd., Weymouth's, Ltd., and Lift Inspection & Insurance, Ltd., all affiliated concerns, yielding good returns. A bonus has been paid, amounting to 10 per cent. on the company's issued capital, in the shape of shares in Weymouth's, Ltd., to shareholders subscribing their quota of the new issue of 47,520 shares. This issue brought the capital of the company up to £285,120, and provision has been made for a dividend on 118,100 shares which debenture holders may elect to subscribe in exchange for their debentures.

The profit earned by Standard-Waygood, Ltd., has not been brought into the year's figures, but is carried forward. This company (Standard-Waygood, Ltd.), the shares in which are practically all held by the English Electric Co. of Australia, Ltd., has been used to purchase the 100,000 "A" ordinary shares which have been surrendered and will be cancelled. The cost, £10,000, forms a goodwill item in the books of Standard-Waygood, Ltd., and, at this figure, the goodwill is not over-valued. It is the only item of that description among this company's assets. The amount brought forward from last year was £30,310, less bonus distributed to subscribers of new issue £23,760, leaving £6,550. The profit for 1921-22 was £46,543, making £53,093, out of which a dividend at the rate of 10 per cent. per annum was recommended, payable 1s. per share after the meeting, and 1s. per share on December 15th, 1922.

[Accompanying our copy of the directors' report is a pamphlet giving a number of photographic reproductions of the various departments of the new works, also of the stator of the first turbo-alternator constructed in Australia (3,500 h.p.), transformers, switchboards, &c.]

Cordoba Light, Power and Traction Co.

The report for the year to March 31st, 1922, states that the accounts have been drawn in accordance with the scheme of arrangement sanctioned by the the Court last February. The balance brought forward was £106,208. Against this, in accordance with the scheme, there has been debited £69,300, being 5½ years' arrears of dividend to March 31st, 1921, less tax, on the preference shares. These arrears have been satisfied by the issue of ordinary shares of the company. £5,000 has been transferred to share capital redemption fund, leaving £31,908, which has been applied towards reduction of discounts on renewal on December 1st, 1920, and recent conversion of promissory notes, and meeting other expenses of capital reorganisation. The accounts for the year, after providing for administration expenses and charging £56,750 for interest on debenture stock and promissory notes, £9,126 for loss on exchange, and £8,000 for taxes, show a credit balance of £54,669, less £9,038 set aside for debenture stock redemption, leaving £45,630. Dividend on cumulative preference shares in respect of half-year to September 30th, 1921 (after deduction of tax), satisfied by issue of ordinary shares, absorbed £6,300; dividend on cumulative preference shares in respect of half-year to March 31st, 1922 (after deduction of tax), paid in cash, £13,324; set aside for redemption of preference and ordinary share capital, £5,000; applied in writing off balance at March 31st, 1922, of discounts arising from conversion of promissory notes and other expenses of scheme of reorganisation, £15,304, leaving to be carried forward £5,701. Since the date of the accounts there has been issued further £150,000 six per cent. debenture stock, carrying interest from April 1st, 1922.—*Financial Times.*

Spanish Companies.

The payment of the following dividends is announced:—Sociedad Electrica de los Almadenes (Alicante), 25 per cent. to the shares numbered 4,001 to 6,000. Electricas Reunidas de Zaragoza, 15 per cent. (75 pesetas per share). Compañia Hispano-Americana de Electricidad, 9 per cent., or 45 pesetas per share. Siemens-Schuckert Industria Electrica, S.A., 36 pesetas per share. Electrica de Guadalajara, S.A., 6 per cent.

Tranvia Electrico de Aviles.—An issue of 3,000 bonds bearing 7 per cent. interest and repayable in 10 years has been made by this company, a preference being reserved to the existing shareholders *pro rata* with the shares held.

Tranvias de Zaragoza.—The liquidators have decided to proceed to a distribution of a first dividend of 10 per cent. without waiting for the result of the negotiations for the realisation of the residue of the assets, as the present circumstances, and especially the failure of an Italian bank, counsel the provisional suspension of the realisation.

Tranvias Electricos de Tenerife.—An extraordinary meeting of this company was held to sanction the payment of the arrear interest on its bonds, coupons 26 to 37, or those from

January 1st, 1917, to July 1st, 1922, being authorised to be liquidated.

Tranvias de Gijon.—This company has issued 1,100 6 per cent. bonds, redeemable in 25½ years, the issue price being 475 pesetas per 500-peseta bond.

Sociedad Española del Acumulador Tudor.—An extraordinary meeting on May 31st sanctioned the distribution of a dividend of 10 per cent., or 50 pesetas per share, or, less tax, 46.15 pesetas.

An Italian Company.

Società Generale Italiana Edison di Elettricità.—The report of this company for the year 1921 shows that the company has keenly felt the effects of the drought. To supplement the serious lack of power unexampled since the starting of the company, resort had to be had to steam-generated current to the extent of 32,000,000 kWh, with the natural serious effect on the balance on the working. To guard against the possible recurrence of similar happenings, it had been decided to install a new reserve steam plant of 10,000 kW capacity. The accounts show an active balance of 12,810,700 lire, allowing of the distribution of a dividend of 32 lire per share. The capital of the company is 180,000,000 lire.

Prospectuses.—*Auckland Electric Power Board* (5½ per cent. Loan).—The list was opened on Monday in an issue of £350,000 in debentures to bearer of £100 each, the price being £100 per debenture. This loan, which is the first portion of the board's first debenture issue of £600,000, is issued to provide funds in connection with the purchase from the Auckland City Council of the lands, buildings, plant, machinery, transmission lines, stores and other material owned and utilised by the Council for the purposes of its Electricity Department, as specified in the sale agreement set out in the Schedule to the Auckland Electric Power Board Act, 1921, and to continue the undertaking as a going concern.

County of London Electric Supply Co., Ltd.—The subscription list was opened on Monday in this company's issue of 500,000 six per cent. cumulative preference shares of £1 each at par and 500,000 ordinary shares of £1 each at 22s. 6d. per share. The purpose of the issue, as our readers are aware is the erection of the Barking generating station (capacity 100,000 kW in the first instance).

Launceston and District Electric Supply Co., Ltd.—The revenue during 1921 was £3,045, as against £2,347 for 1920; the working expenses were £1,497, against £1,512, leaving a gross profit of £1,547. After paying debenture and preference interest, the net profit was £1,131, plus £110 brought forward, making £1,241. As the amount of dividend permissible under clause B of the Launceston Electricity (Temporary Increase of Charges) Order would be only fifteen-sixteenths per cent., it would be so small (£60) that it is proposed that the sum be reserved to add to future dividends. £350 is to be put to depreciation, £150 to reserve, £214 is to be written off the cost of the Provisional Order, and £467 is to be carried forward. The new sawdust plant is giving entire satisfaction. The number of consumers has increased from 320 to 362, and the lamps connected from 12,506 to 13,774.

City of London Electric Lighting Co., Ltd.—The following dividends are announced for the half-year ended June:—At the rate of 6 per cent. per annum on the first preference shares; at the rate of 8 per cent. per annum on the second preference; and 1s. per share (at the rate of 10 per cent. per annum) on the ordinary shares; all less tax at 5s. 6d. in the £.

Charing Cross, West End & City Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1922, at the rate of 5s. per share.

Rushden and District Electric Supply Co., Ltd.—Interim dividend for the year of 3½ per cent. on the share capital.

Northampton Electric Light and Power Co., Ltd.—Interim dividends for the year of 4 per cent. on the ordinary "B" shares and 2½ per cent. on the 5 per cent. preference "B" shares.

Chatham and District Light Railway Co.—Interim dividend of 5 per cent. per annum, less tax, on the ordinary shares.

Veritys, Ltd.—The financial Press states that no interim dividend is being paid on the preference shares.

County of London Electric Supply Co., Ltd.—Interim dividend on ordinary shares for the half-year ended June 30th, at 6 per cent. per annum, less tax, as compared with 5 per cent. last year.

Hong-Kong Tramways Co.—According to the *Financial Times*, the directors have declared an interim dividend on account of 1922 of 1s. per share.

Liverpool Overhead Railway Co.—The directors announce that they are unable to declare an interim dividend on either the preference or ordinary shares.

National Gas Engine Co., Ltd.—Interim dividend on the ordinary shares at the rate of 7½ per cent., less tax.

Brompton & Kensington Electricity Supply Co., Ltd.—Interim dividend at the rate of 9 per cent. per annum, less tax, on the ordinary shares for the half-year.

Hadfields, Ltd.—Interim dividend of 6d. per share, free of tax, on the ordinary shares.

Chelsea Electricity Supply Co., Ltd.—Interim dividend of 8 per cent. per annum, less tax, on the ordinary shares for the half-year.

Lanarkshire Tramways Co.—Interim dividend of 5 per cent. per annum, less tax, for the half-year.

STOCKS AND SHARES.

TUESDAY EVENING.

THE general trend of markets in the Stock Exchange is distinctly good. In spite of the near approach of the holidays, money is flowing into the investment departments, and although the price of the War Loan remains within close touch of par, the demand for sound stock is sufficiently insistent to make itself felt in other securities of which there is less ample supply.

The County of London Electric Supply Company secured immediate success on Monday morning with its issue of half a million ordinary shares at 22s. 6d., and the same amount of 6 per cent. preference shares offered at a pound. The lists were kept open until Wednesday in this week for applications from the company's shareholders, which seems to be an eminently reasonable and fair proceeding, although from the public no further subscriptions were received after eleven o'clock on Monday morning. Allotment letters are expected to be posted with the promptitude for which the company is well-known, and there can be little doubt that a premium will be established, from the start, upon both classes of shares. As showing the appreciation of the public for good investments, it is interesting to mention that the demand for the company's 6 per cent. preference is said to have been almost as great as that for the ordinary shares.

Bengal Telephone new scrip started off at 3¼ premium on the opening of the market on Tuesday. So great was the rush of stags to sell, that one firm in the Stock Exchange bought £100,000 within a couple of hours. The price consequently gave way to 2 premiums. It is fairly safe to prophesy that this premium will be doubled before long.

The Metropolitan Electric Company's increased dividend was followed by a rise in that of the Chelsea Company, and the difficulty of buying good shares in this section is more than ever pronounced. Chelseas rose 5s. to 6. The County's interim dividend is raised from 5 per cent. to 6 per cent. These results encourage the expectation that for the full twelve months something better may be achieved than the dividends paid for 1921. The County of London ordinary shares at 1¼ are 1/16 down, on selling by those who wish to take up the new shares, but the preference remain at 1.1/16.

Edison Swans have fallen to 3s. 9d., but General Electrics are better at 19s. 6d. on the assumption that the company has seen the worst of its recent troubles, and that the current year is likely to prove a more profitable period than that just ended, for which 5 per cent. dividend was paid. English Electrics hold their rise, and Cromptons remain a good market at 15s. Speaking generally, there is not a great deal doing in the shares of the manufacturing concerns.

The new 4½ per cent. debenture stocks of the City and South London and of the London Electric Railways have both risen to 2 premium over the issue price of 94. This is a rather amusing sequel to the slight indignation expressed at the time that the issues were made, when the price asked was politely derided as being too high. The stock is now firmly in the hands of investors, and, having regard to other stocks of similar nature, it is reasonable to assume that they will go quietly to the neighbourhood of par. The only deterrent is the possibility of new issues, and there are whispers of a substantial amount to be offered in the near future. Underground Electric income bonds have recovered the 2 points shed last week, but the ordinary shares of £10 receded to 45s. There seems to have been a big block of the latter recently for sale; possibly the whole line of shares has not yet got into permanent hands.

This week has seen the official jubilee celebration of the Eastern Telegraph Co. and its associated undertakings. Most of the papers have contained articles in connection with the event, and the directors of the group will feel that they have earned, by their able handling of the interests under their charge, the encomiums laid before the companies and the industry which they have created. From the Stock Exchange point of view, the only price-change is a rise of 5s. in Western Telegraph. Elsewhere in this market, Great Northerns are 10s. up to 29.

The American cable list is steady. This is more than can be said of Marconi shares. The price of the parent Marconis dwindled to 2½ on renewed uneasiness with regard to the forthcoming dividend announcement. This was expected to be made public at the end of July, but Stock Exchange gossip says that the date is more likely to be somewhere about the middle of August. Doubts are beginning to arise whether the company will pay even 5 per cent. as the final dividend for the year, which would make 10 per cent. altogether. It is impossible, however, to estimate what is likely to be announced, and those who bought the shares for the longer shot are probably content to hold them in the face of whatever the immediate dividend declaration may prove to be. Marconi Marines have given way to 26s., and the rest of the list is heavy.

Brazilian Tractions hardened to 52, and Mexico Tramways 6 per cent. bonds at 45½ are again 3 to the good. There is still no definite news with regard to Mexico, but hopes are beginning to revive on much the same lines as those which, for the past few years, have occasioned spasms of strength in the Utility companies' bonds. British Columbia Railway issues are dull, the preferred stock giving way sharply upon a little offering of stock.

Yorkshire Electric Power 5½ per cent. debenture stock has improved to 102, upon investment inquiry being directed to this issue by reason of the security which backs the stock. Interest is payable on April 1st and October 1st, and the stock is secured as a first charge on the company's property and assets. It is redeemable in 1944 or earlier, upon six months' notice being given, at 100, and the profits for 1921, before payment of interest on mortgages, debenture stock and loans, came to a little over one hundred thousand pounds.

New issues are steady, and it is a matter for some surprise that the recent improvement in India Government stocks has not been followed by sympathetic advances in the prices of Calcutta Electric second debenture, Indian Electric Supply and Madras Electric debenture stocks, a trio which deserves consideration from the investor who is not afraid of Indian securities that offer a good return upon the money.

The iron and engineering sections show no particular change, though news from the North would seem to imply that some of the companies are beginning to turn the corner of adversity. Rubber shares show little alteration. Here, again, the tendency is a shade more hopeful than it has been, timid optimism building upon the hope that the expected legislation on the part of the Dutch Government, for restriction of rubber output in the Netherlands East Indies, may shortly become an accomplished fact.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	1921.	Price July 25, 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	7½	—	6 4 2
do. do. do. 4½ Pref.	4½	4½	3⅝	—	5 16 2
Chelsea	6	6	6	+ ½	5 0 0
City of London	14	14	2	—	7 0 0
do. do. 6 per cent. Pref.	6	6	22/6	—	5 6 8
County of London	8	8	1½	— ⅛	6 8 0
do. do. 6 per cent. Pref.	6	6	1/-	—	5 13 0
Kensington Ordinary	9	10	7½	—	7 0 7
London Electric	2½	4	2⅝	—	5 14 0
do. do. 6 per cent. Pref.	6	6	5	—	6 0 0
Metropolitan	7	7	5⅝	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3⅝	—	5 16 2
St. James' and Pall Mall	12	12	8½	—	6 17 2
South London	7	7	3½	—	8 0 0
South Metropolitan Pref.	7	7	1/-	—	5 18 0
Westminster Ordinary	10	10	7½	—	6 18 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref	6	6	104xd	—	5 15 5
do. Def.	1½	34/6	23⅜	—	7 7 6
Chile Telephone	6	6	6⅞	—	4 17 0
Cuba Sub. Ord.	7	7	8½	—	8 4 8
Eastern Extension	10	10	186xd	—	5 8 1
Eastern Tel. Ord.	10	10	186xd	—	5 7 3
Globe Tel. and T. Ord.	10	10	19½	—	5 4 7
do. do. Pref.	6	6	11½	—	5 6 8
Great Northern Tel.	24	22	29	+ ½	7 11 8
Indo-European	10	10	36½	—	6 17 0
Marconi	25	15	2⅜	— ⅛	7 1 2
Oriental Telephone Ord.	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	8	8	7⅜	—	*5 12 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	+ ½	*5 5 3
HOME RAILS.					
Central London Ord. Assented	4	4	68	—	5 17 8
Metropolitan	1½	2½	45	—	4 13 9
do District	Nil	1	20	—	2 11 3
Underground Electric Ordinary	Nil	Nil	2½	— ⅛	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	2	4	81½	+2	*4 18 2
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	8½	—	7 17 2
do. do. 2nd Pref.	Nil	5½	3½	—	7 2 0
do. do. 5 per cent. Deb.	5	5	81½	—	6 4 3
Brazil Tractions	Nil	Nil	52	+1	7 13 10
British Columbia Elec. Rly. Pcc.	5	5	76	—4	6 10 9
do. do. Preferred	5	20/-	68½	—1	*6 15 0
do. do. Deferred	3	124/-	75½	—	*8 4 6
do. do. Deb.	4½	4½	78	—	5 9 0
Mexico Trams. 5 per cent. Bonds	Nil	Nil	71½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	45½	+3	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	52	—	Nil
do. 1st Bonds	Nil	5	68½	—	7 6 0
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	3	—	5 6 8
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	2⅜	—	7 1 2
Callenders	15	15	2⅛	+ ⅛	6 16 4
,, 6% Pref.	6½	6½	1⅛	—	5 9 5
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	3/3	—⅛	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1½	—	8 0 0
English Electric	8	5	17/6	—	5 14 3
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	19/9	+1/6	5 1 3
Henley	15	15	2½	—	6 13 4
do. 4½ Pref.	4½	4½	4⅛	—	5 2 10
India-Rubber	10	—	⅞	—	—
Mst.-Vickers Pref.	8	8	2⅞	—	6 11 2
Siemens Ord.	10	10	1½	—	*7 12 4
Telegraph Con.	20	20	26xd	—	*4 12 2

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 26th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per lb.	8d.	...
a Ammoniac, Sal ... per ton	£68	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ,,	...	...
a Borax ... ,,	£30	...
a Copper Sulphate ... ,,	£27	10s. dec.
a Potash, Chlorate ... per lb.	5d. to 5½d.	...
a ,, Perchlorate ... ,,	7¾d.	...
a Shellac ... per cwt.	£18 5s.	10s. dec.
a Sulphur, Sublimed Flowers ,,	£12	...
a ,, Lump ,,	£11	...
a Soda, Chlorate ... per lb.	3½d.	...
a ,, Crystals ... per ton	£6	...
a Sodium Bichromate, casks ... per lb.	5¾d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton	£120	...
b ,, Wire ... per lb.	1/9 to 2/6	...
b ,, Sheet ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... per ton net	£150	£3 inc.
Grade II ... ,, ,,	£108	£2 inc.
Grade III ... ,, ,,	£62	£1 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	...
c ,, Tubes (solid drawn) ,,	11⅛d. to 1/-	...
c ,, Wire, basis ... ,,	9½d.	...
c Copper Tubes (solid drawn) ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£94	...
c ,, Sheet ... ,,	£94	...
c ,, Rod ... ,,	£94	...
d ,, (Electrolytic) Bars ,,	£71 10s.	5s. dec.
d ,, ,, Sheets ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£81 10s.	5s. dec.
d ,, ,, H.C. Wire per lb.	10⅞d.	½d. inc.
f Ebonite Rod ... ,,	3/6	...
f ,, Sheet ... ,,	3/-	...
n German Silver Wire ,,	2/6	...
h Gutta-percha, fine ... ,,	12/6	...
h India-rubber, Para fine ... ,,	9½d.	½d. dec.
i Iron Pig (Cleveland Warrants) ... per ton	90/-	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£35	...
g Lead, English Pig ... ,,	£27	£1 5s. inc.
g Mercury ... ... per bot.	£11 5s. to £12 10s.	...
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/1	...
p ,, drawn bars and rods ,,	1/3	...
p ,, rolled strip & sheet ,,	1/2½	...
p ,, wire ... ,,	1/3½	...
o Platinum ... ... per oz.	£19 10s.	...
d Silicium Bronze Wire ... per lb.	1/1	...
r Steel, Magnet, in bars ... ,,	1/-	...
n Tin, Block (English) ... per ton	£160	£6 15 to £7 10
n ,, Wire, Nos. 1 to 16 ... per lb.	3/-	... (inc

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Telephone "Pages."—In one of the first-class hotels in Boston, Mass., the loud-speaking telephone is being used instead of page boys. The manager of the hotel declares, says the *Evening News*, that the system gives more efficient service. There is no longer a number of noisy boys running through the main dining rooms shouting the names of the guests wanted on the telephone. Instead, the voice of the telephone operator is being sent to various parts of the hotel through devices from the telephone switchboard. The operator calls into the transmitter beside the switchboard that a guest is wanted, and her tones are carried out into the hotel by amplifying apparatus.

Sound Ranging.—Many parts of the American coast are badly charted. Hitherto sounding has been done with the Kelvin machine, in which the pressure of the water compresses the air in a sensitised tube and wets it along a graduated scale. But during the war it was found that with the hydrophones employed to detect submarine activities the depth of water could be judged by the time taken to receive the echo of a sound signal. This discovery has now been developed into a system which enables a depth to be measured within a few feet.

Col. Theodore Roosevelt, the Assistant Secretary of the Navy, announced recently that successful tests had been made during a voyage of the United States destroyer *Stewart* from Newport News, Virginia, to Gibraltar.

The British Admiralty recently announced that a vessel had been equipped to take observations by the same means in this country.

THE NERVES OF THE NATIONS.

The Romance of the Submarine Cable.

By ROLAND BELFORT.

(*Concluded from page 77.*)

"*Girdling the Earth.*"—We of the present generation have no conception of the immense excitement and acrimonious discussions that accompanied the plucky attempt of the pioneers to lay the first Atlantic cable. Inexhaustible their patience in the face of exasperating delays, superb their pluck when confronted by successive disasters that would have unnerved most men. The feasibility of this grandiose scheme was contemptuously denied by many eminent scientists, French and English. Press campaigns raged for and against the project. Prominent financiers pronounced it absolutely impracticable from the financio-commercial standpoint. Numerous romantic and exciting episodes marked each stage of this epochal enterprise. After endless disasters, terrible losses, and crushing disappointments, John Pender and his supporters succeeded in establishing cable communication across the Atlantic on a commercial basis, thereby conferring substantial benefits on all classes of the community on both sides of the Atlantic. Then these hardy pioneers, seeking fresh cable worlds to conquer, secured financial support and turned their attention to other regions—the Mediterranean, the Red Sea, the Indian Ocean, the Far East, our Australian colonies, South America, South Africa, West Africa, and other countries. From their historic headquarters in Old Broad Street—long before their installation at Electra House, Finsbury—the Eastern pioneers literally materialised Shakespeare's dream of "girdling the earth in forty minutes." Incidentally, they made London the centre of the world s nervous system; a vast distributor of telegraphic news from all quarters, thus giving this country a pre-eminence in that department which has yielded inestimable results, moral and material. Happily, the companies have prospered, while organising an enterprise of Imperial importance—an indispensable factor in every manifestation of international activity. Today they are reaping the harvest of the financial, administrative, scientific, and diplomatic ability displayed through fifty years of persistent effort, handicapped by a succession of serious obstacles.

Famous Foreign Cable Pioneers.—Among foreign cable pioneers, besides Cyrus Field, Gisborne, and Morse, we find Julius Reuter and Baron d'Erlanger, who, with other Continental capitalists, founded the first French Atlantic cable company. But, capitulating to what Napoleon called "the cavalry of St. George," they soon sold their enterprise to Sir John Pender's group, whose policy was "beneficent monopoly." This surrender terminated a series of exciting conflicts between the rivals; cables were mysteriously broken; exasperating delays occurred, sensational polemics raged between the Press of Paris and London. Not long did Sir John remain the autocrat of the Atlantic. For the Direct United States Cable Co. was formed by Julius Beer and certain other prominent financiers. This company never developed any conspicuous strength; misfortune overtook it, and it was finally absorbed by the stronger combination controlled by the indefatigable Pender. Again the latter dominated Atlantic cabling.

Romance of the "P. Q."—But this field of action was far too attractive to escape the ambitious attentions of financiers and promoters. About 1878 Count Arthur Dillon, a French cavalry officer of Irish origin, conceived the patriotic idea that France could and should control her own cables. With admirable patience he acquired the necessary scientific, mechanical, and administrative knowledge and got into close touch with manufacturers, managers, and even operators. Soon the cable had no secrets for Dillon. A man of commanding presence and charming manners, endowed with a persuasive tongue and fortified by a splendid college and military training, he achieved a reputation as a promoter destined to succeed. He then turned his attention to the financial aspect of the cable question, and secured the co-operation of Pouyer Quertier, a powerful financier and cotton magnate who had been French Minister of Finance, and was also an influential factor in Paris banking enterprise. Pouyer Quertier, with Dillon, proposed to lay two cables from Brest to New York. When everything was ready to the last detail the human element suddenly appeared and ruined all Dillon's plans. For Pouyer Quertier insisted on having the company floated at an unfavourable moment, from the Bourse standpoint. Having decided to leave Paris to please a charming comedienne in whom he just then took a tender interest, Pouyer Quertier wanted the flotation rushed through in consequence. Dillon was, of course, astonished and disgusted—but powerless. The issue was made and proved a fiasco. But he valiantly kept the threads of the scheme together, and, after two years of anxiety and hard work, had the satisfaction of successfully floating the company with Pouyer Quertier as chairman. One cable was laid and work commenced in 1880 under favourable auspices.

Jay Gould's Ambition.—Then, two years later, the famous American financier, Jay Gould, decided to lay two cables across the Atlantic, and proceeded with characteristic daring. He cabled Messrs. Siemens, London: "Cable estimate for making and laying two Atlantic cables." Promptly that famous firm replied with an estimate of over £1,000,000. With equal celerity Gould cabled: "Make and lay two cables according estimate; £50,000 at your bankers here." These cables were promptly made and laid. For some time it was uncertain whether Jay Gould would join forces with the French company or with the British combination. Finally he elected to work with the latter.

Fatal Human Element.—Here Count Dillon was dogged by bad luck, again due to the introduction of the fatal human element. He sent his traffic manager to New York to treat personally with Jay Gould. The latter had practically accepted a working arrangement with the "P. Q." company, whereby the latter would have secured the use of his Western Union Telegraph Co.'s vast land line system throughout the States, while he himself would dispose of two cables to prolong that system to Europe. But what happened? Dillon's traffic manager, for purely private reasons, did not appear eager to see the negotiations succeed. He may have thought that Dillon's failure would have been his opportunity to succeed him as managing director. Whatever his secret motive, he *mailed* Jay Gould's momentous decision instead of *cabling* it. Naturally, the puissant financier, who expected a quick reply, was too impatient to wait long. He therefore broke off the negotiations and joined the British ring. Had the Dillon-Jay Gould combination materialised, we might probably have never heard of the Commercial Cable Co. For Dillon, its promoter, would have joined forces with Jay Gould and developed, with him, certain ambitious plans, which included four cables across the Atlantic, a big international cable bank, and a double line of cables across the Pacific.

British v. *French Diplomacy.*—Having absorbed the Jay Gould company, Sir John Pender endeavoured to compel the "P. Q." to joint his ring and accept a joint working arrangement by starting a war of tariffs. Dillon strenuously opposed this amalgamation, but Pouyer Quertier, who was having trouble with his cotton enterprises, and needed ready money, finally decided to accept the British offer. Being president, a big shareholder, and possessing enormous influence among

shareholders and in financial circles, "P. Q." was master of the situation. The final negotiations took place in Paris. While Pouyer Quertier was settling the final terms with the British in one room of the "P. Q." offices, Dillon was in the next room *laying the foundations of a new Atlantic company* destined to break for ever the British monopoly.

Dillon persuaded two American millionaires, John W. Mackay and James Gordon Bennett, who did not love Jay Gould, to join forces with him for the laying of two Atlantic cables. These were made, laid and opened to the public in record time. Then the new company found itself alone in fighting the four old associated companies —Anglo, Direct, Jay Gould, and French "P. Q." Justice compels me to admit that Sir John Pender did not develop his traditional diplomatic genius in meeting these redoubtable competitors. Dillon, approached for some "friendly understanding," proposed to discuss it through an "Atlantic Cable Committee," composed of Weaver, Sir John's man, Dillon himself, and one or two other members. Endless discussions took place; adjournments and postponements occurred; many months elapsed. Suddenly Sir John Pender awakened to the fact that Dillon was the *Weaver*. For he had woven a web around him that promised to prove disastrous. The more they negotiated the less progress was made. The inevitable happened. War was declared. But too late. Dillon had made such a splendid start for over a year that he was able to say to Pender: "Very good; we fight. Carry the traffic at sixpence and lose money. We shall charge 1s. per word and get public support as the pioneers of this low rate, *undertaking never to raise it above that figure.*" Sir John was, of course, "cornered." He finally accepted the 1s. tariff imposed by his rivals, and no change has since been made. Here it may be noted that Count Dillon not only broke the Atlantic cable monopoly, but also re-secured control of his old company, the "P. Q.," with the assistance of his associates.

To-day, as everybody knows, the Americans practically dominate the Atlantic cable industry. Noteworthy is this significant fact: While the British have *laid* the cables and *worked* them, foreigners have consistently fought for *lower tariffs* across the Atlantic.

Modern Cable Magnates.—Ever since its inception the cable has commanded the services of a succession of brilliant financiers, scientists, and administrators, both British and foreign, as the foregoing details clearly prove. Sir John Pender I. has passed into cable history as the most remarkable of these pioneers. For he combined in his person all the qualifications needed for such a dominating position. He was financier, administrator, diplomatist, and even scientist on occasion. Perhaps his success was due, in the main, to that indomitable pluck and determination which, combined with untiring energy, enabled him to realise his most grandiose schemes. Frequently his time and energy were expended in overcoming the opposition or apathy of those who ought to have better appreciated his enterprise and facilitated his efforts. Notably, certain Colonial Ministers, who were disposed to depreciate the value and potentialities of our Colonial Empire. How often Sir John had to go to the Colonial Office and force, by sheer will power, the Minister in office to permit him to confer upon some colony the inestimable boon of cable communication with the Mother Country! His success led to the curious legend that "Pender carried the Colonial Office in his waistcoat pocket." Sir John, a splendid judge of character and expert in the art of managing men, surrounded himself with some of the keenest, brightest spirits of his time in all departments—Sir Charles Bright, Lord Kelvin, Sir James Anderson, the famous captain of the *Great Eastern*, Alexander Muirhead, Varley, Willoughby Smith—to name only a few. To my mind the importance of Bright's pioneer work was never adequately recognised. Apart from his scientific and technical successes, he was a cable enthusiast, an active propagandist, and the *first subscriber* to the pioneer Atlantic Telegraph Co.

Future of the Eastern.—In his Eastern Telegraph enterprises, Sir John Pender I. mobilised a big brigade of scientists and technicians, resourceful administrators and financial experts, who found ample scope for their ability at home and abroad. Other valuable collaborators in the great work were: Glass, Elliott & Co., the Newalls, the Telegraph Construction and Maintenance Co., of which Sir John was the first chairman; Siemens Brothers, the Silvertown Co., associated with the famous Gray family; and Henley's. These corporations have made, laid, and repaired the majority of the cables now lying beneath the waters of the Seven Seas.

To-day all the original founders of the Eastern Telegraph enterprise have passed away, but their mantles have fallen upon successors who are continuing their far-sighted, progressive policy. The control is now exercised by Sir John Pender II., who sees the enterprise enjoying a prosperity and a *prestige* commensurate with its vast organisation and capacity for beneficent international service. He is, of course, ably seconded in his administration by a number of experts in London, as well as by resident representatives and station managers throughout the world, the latter being well supported by an efficient, zealous staff.

Whatever may be the future reserved for cable enterprise, the Eastern group may be expected to maintain its traditional and pre-eminent position. Sir John Pender II. has revealed many of those qualities of energy, sound judgment, and financial acumen which enabled his father to accomplish his historic work. The popularity enjoyed by Sir John with his staff has just found expression in a handsome volume which they have presented testifying, above 8,000 signatures of men scattered all over the world, to their personal regard and loyalty.

"Electric Heating by Accumulation."—A further contribution to the subject of the title has been published by the E.D.A., supplementing the note in our issue of June 23rd (p. 884). The attention devoted in this country to water-heating and heating by water has overshadowed the alternative method of accumulating heat for subsequent release by "dry" methods. One appliance for this purpose is the Harrison & Peard heat accumulation stove. This stove consists broadly of a suitably-lagged containing body, through which air can be circulated by the opening of dampers, supplemented, if necessary, by the use of fans. Within the body of the stove are situated vessels or reservoirs containing any suitable substances of large heat-storing capacity for a rise of temperature not greatly exceeding the temperature at which heat is required from the appliance. The substance may be water, chemical solutions, or solid substances which liquefy on heating. In a model already made for room warming, acetate of soda has been employed as a heat storage material. When this salt, in the form of crystals, is melted, much heat is absorbed without increase in temperature, and this latent heat of fusion is given off again when the substance recrystallises. The vessels containing the storage substances, or the masses of material employed for that function, are heated up by means of electrical elements placed in or around them. The losses by radiation during the period of charging or storage are comparatively low, and under control, that is to say, the stoves may be designed to give off a portion of the heat input during charging and to store a portion for use during the non-charging period. Heat is released, as above stated, by the operation of dampers, which allow air circulation, which may or may not be assisted by fans, and the heated air of moderate temperature and large volume is discharged at or near ground level, so overcoming the "cold feet" difficulty apt to arise with convective heating, which does not warm the floor until after the air of the room has been heated up and perhaps become stuffy.

The use of the fan also results in a reasonable movement of the air, which, to a great extent, reduces the enervating effect of air warming. Obviously, many modifications under these patents suggest themselves, and it would not be difficult to provide, say for 80 per cent. of the heating effect required in a room by storage convector, and 20 per cent. by a radiant fire element, so producing an apparatus which would satisfy every need of the user and yet enable the supply undertakings to meet extensive demands without embarrassment or the necessity for charging unduly high rates. The whole subject of heating by stored energy is worthy at the present time of the most careful consideration by manufacturers and supply undertakings. A great deal of success has already been achieved in this direction in Switzerland, Italy, and Scandinavia.

CABLES.

By "A STATION ENGINEER."

It is now being generally recognised that armoured cables provide the most efficient means for transmitting electricity. Some years ago, there was a great movement in favour of the solid system, but this has largely died down. The solid system is expensive, and offers far less protection than seems to be the case at first sight. It is liable to damage if the ground be disturbed underneath, a possibility far from uncommon in a busy town. The solid system also retards the escape of heat to an undesirable extent, and this is an important objection now that the heating of cables in the ground is becoming a limiting factor almost as important as the heating of conductors in transformers and running plant generally. The hope that bitumen cables would be entirely free from trouble has been falsified by experience. Far from this being the case, bitumen cable is more liable to faults than plain lead-covered paper-insulated cable, while the solid protection of V.B. cables sometimes interferes in a curious manner with the localisation of faults when they do occur.

The draw-in system has disadvantages even more serious than those of the solid system. Where cables are run at high densities, as is possible with high-pressure supply, the draw-in system provides a blanket of air round the cable which effectually conserves the heat, and renders the cable liable to overheating, if run for long periods under load. Where several ducts are run close together, the draw-in system is particularly liable to over-heating. The liability to gas explosion, the cost of installation, the cost of draw-in boxes, and the fact that these monopolise the street seriously, are further disadvantages which need not be elaborated.

Until recently, round cores had been most favoured for armoured cables, but shaped cores are now coming into vogue. The fact that shaped conductors are appreciably cheaper has something to do with this, but some engineers prefer them even at equal prices. There was a report some time ago that, owing to its smaller outside diameter, the three- or four-cored cable with shaped conductors would carry less current than one with round conductors, but there is some doubt whether this fear is justified. While it is true enough that the shaped cores go into a smaller space, one has to recognise that the extra space with round cores is filled up with insulation which is also a bad conductor of heat. Probably there is little to choose between the two styles of cable from a heating point of view.

The round cores are more convenient for making "Tee" service joints, where these are spliced on to the main cable without cutting the cores. The extra space inside the lead is a distinct advantage when it comes to forcing the cores apart, to enable the "Tee" cable to be spliced on. A closely made up cable with shaped cores gives far less opportunity for making a "Tee" splice, although it is not impossible to a skilful jointer. It is to be noted that shaped-core cables vary in this respect. Some cables are made up with the cores fitted together so closely that no filling-in material whatever is used, and these are particularly awkward for taking off "Tees." Other makers use an appreciable amount of worming to fill up spaces between the cores; this is helpful to the jointer, and the cable is more suitable for distributor work, although the first kind is probably just as good for feeder cables, where no "Tees" are required.

Methods of shaping the cores differ greatly. In one case the cores are made up round in the first case, and are pressed into shape by dies; the cable passes between the dies, and is pressed a few inches at a time. This method seems to harden the copper somewhat, which is undesirable. Other makers pass the round cores between grooved wheels, which force them into triangular shape, the effect being very much the same as in the first case Other makers use cores made up of very fine strands, which are pressed into triangular shape by grooved wheels without effort, and without any distortion of the strands. This makes an attractive and flexible cable, but it has the serious disadvantage that the fine strands may be burnt and damaged if "Tee" joints are soldered with very hot soldering metal. This disadvantage is worthy of note, and there is no doubt that a good deal depends on the skill of the jointer where such cables are used. In a further design, triangular cores are laid up into triangular shape by the use of strands of special sizes. These cores come from the machine of correct shape, and need no pressing afterwards, and they appear to make a particularly good job.

It would be interesting to have the opinions of various users whether the shaped-conductor cable is as good as, or better than, the round-core type. I suggest the following opinion, which may form a basis for discussion:—

1. For cables pulled into pipes, the shaped conductors are better, being more flexible, and less liable to distortion under the strain of drawing in.

2. For large cables the shaped conductors have advantages over round cores. The smaller diameter makes the cable better for handling.

3. It is an advantage to have a certain amount of worming to fill the spaces between the curved corners of shaped conductors. Conductors made with sharp corners may be made without the filling-in, but these are less satisfactory than those with rounded corners, being more difficult to force apart for jointing purposes, and probably more liable to damage in handling.

4. Small cables, such as those with 0.1 sq. in. conductors and under, are better with round cores.

Protection of Armoured Cables.—Where they are properly laid and jointed with efficient joints, the life of armoured cables may be taken to be indefinitely long so far as internal conditions are concerned. Normal running does not seem to have any bad effect on paper insulation, and so far as can be seen, a cable is as good after twenty years as when laid, provided it has not been over-run.

Cables are far more likely to decay from outside than from within, and it is therefore a proper subject for inquiry, whether the outer protection is sufficiently good. The foremost requirement for an armoured cable is that it should be thoroughly solid with compound; right from the lead to the outside of the serving, every space should be filled with a firm compound, of a flexible and somewhat rubbery nature. Some engineers complain when this compound is sticky, as it gets on to their jointers' fingers. To such, one can only say that it is far better that the jointer should have to wipe his fingers than that the cable should be imperfectly protected. A compound of a sticky nature is just what is wanted. It does not crack, and it keeps water out far better than a mixture of a brittle nature.

It is a distinct advantage to have the armour galvanised, but this often means delay and considerable extra cost. Alternatively, it is worth while to make the serving thicker than the B.E.S.A. specification requires. Some engineers demand a cable laid up with a great deal of special compound, which has its advantages, but the method is not popular with cable makers. They have to provide for such orders a quality of compound quite different from that ordinarily used, and that is both expensive and troublesome.

Possibly a better method is to have the cable wrapped with special compounded Hessian tapes, instead of the ordinary serving. There is no difficulty in doing this, the cost is not excessive, and one may expect that the cable will have a longer life, particularly if the ground be of a nature that attacks cables.

Perhaps our friends the cable makers will give their opinions, which will be welcome. No matter how good a suggestion is, there is not much benefit in it if the manufacturers cannot carry it out.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Elverson Oscilloscope.

We are informed that Messrs. Herbert Kennedy & Co., Ltd., 47, Victoria Street, Westminster, S.W.1, have purchased the undertaking of the Oscilloscope Syndicate, Ltd., and now own the world's rights of the above-named device, which was developed by Mr. A. J. Elverson during the war period. It is a stroboscopic apparatus, by the use of which the apparent speed of a piece of mechanism under examination is reduced to a predetermined fraction of its actual running speed; or the instrument can be so adapted as to make the mechanism under observation appear to be stationary at any point in the cycle of operation. This "optical gear ratio can be made one to 1,000 if needed. The object to be examined is illuminated by means of a special form of electric lamp controlled by the instrument in such a manner that, instead of emitting continuous light, rapid successive flashes take place at regular intervals in the movement of the part of the machine under examination, so that the effect on the eye is that of a series of photographic impressions. By substituting a microphone and telephonic attachment for the lamp, it is possible to enable the ear to analyse mechanical noises and at the same time the mechanism can be examined optically as well if desired. The device is portable, weighing about 35 lb. complete in a case, and it is capable of dealing with all forms of motion, rectilinear, rotary, cam motions (however intricate), and all problems of vibration.

The "Ace" Lighting Fitting.

The British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C.4, has introduced a new design of dust-proof semi-indirect lighting fitting. This is illustrated in fig. 1. The glassware is in one piece—crystal glass treated with a special enamel, fired on the upper surface and

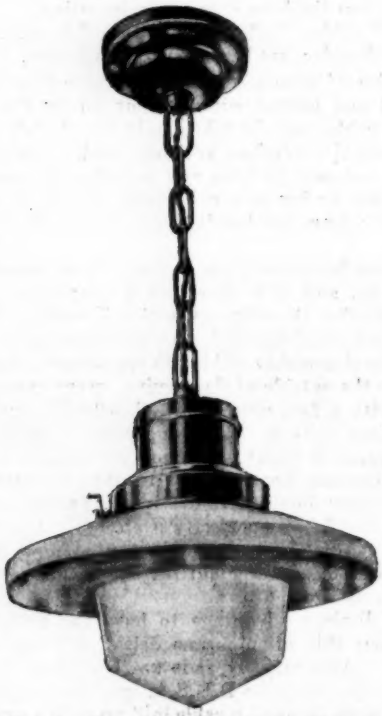

Fig. 1.—The "Ace" Lighting Fitting.

edge, to reflect the light downwards, and on the outer surface of the bowl to diffuse the light and reduce light absorption. Cross reflections are eliminated by the contour of the glass. The fitting is supplied complete with ceiling plate and chain, and, if desired, the bowl can be fitted with an ornamental tassel. It is made in two sizes to take "Mazda" gasfilled lamps of from 100 to 300 W.

The "Little Giant" Rail Drill.

The amount of railway electrification in progress and in prospect makes the apparatus illustrated in fig. 2, of immediate interest. This shows the application of the "Little Giant" drill, manufactured by the Consolidated Pneumatic Tool Co., Ltd., Egyptian House, 170, Piccadilly, W. 1, to rail drilling. It will be noticed that the frame does not need bolting, it is simply hooked over the rail to be drilled, the operator holding down the other end by sitting on the seat provided, which brings him into a convenient position to operate the feed. The side spindle construction permits drilling close to the ties without the use of an angle attachment, and the vertical adjusting screw, with guides for the drill, affords ready means for drilling the holes vertically on ordinary tee or deep girder rails. The horizontal rods are of heavy seamless drawn tubing, and the bearing surface of the drill guides is long enough to ensure the true holes which

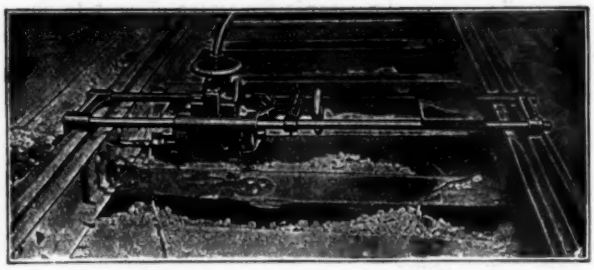

Fig. 2.—The "Little Giant" Rail Drill.

are essential for efficient bonding. The cross-bar carrying the feed nut is fitted on the horizontal rods by means of eye pins, which are easily withdrawn for the rapid removal of the drill from the rail, or for sharpening the drill point. A series of holes in the horizontal rods provides means of accommodating drills of various length. The drill itself can be removed from the frame by taking out four screws; it can then be used as an independent portable tool. The motor is wound for 600 V.

Industrial and Mining-type Switchgear.

The new regulations relating to the installation and use of electricity in coal mines have necessitated the remodelling of mining-type switchgear. Messrs. Ferguson, Pailin, Ltd., Higher Openshaw, Manchester, have therefore developed a range of switchgear which can be employed where regulations 127 and 132 apply. For satisfactory service under the particularly bad conditions that switchgear has to contend with in

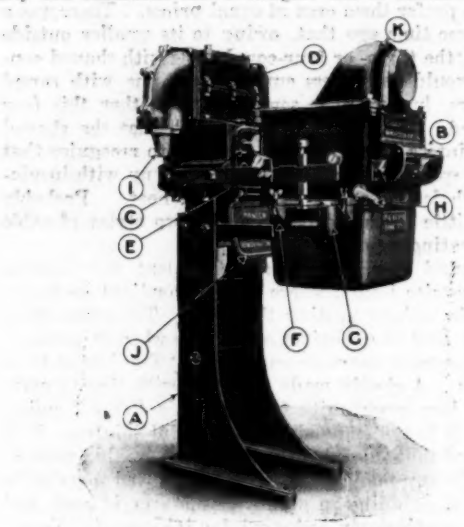

Fig. 3.—Ferguson-Pailin Switchgear.

mines and certain industrial situations, a specially robust pattern of ironclad oil-immersed circuit breaker has been produced. This type of switchgear is of the totally enclosed pattern. It is proof against dust, drippings, and vermin, and is capable of resisting bad atmospheric effects. The design is particularly applicable in outdoor or exposed situations. For use in fiery mines the switchgear is supplied in a special flame-proof patern. All "live" connections in this apparatus are either immersed in oil or in compound so as to render the gear suitable for low-pressure and high-pressure systems.

The construction is on the sectional principle, enabling a complete switchboard to be built up from several sections, or a single unit to be employed as required. A typical section arranged for floor mounting is shown in fig. 3. An alternative design for wall mounting is available. The circuit breaker is closed and opened by means of a "free" handle situated at the side and screened by the main body. The free-handle

feature operates throughout the whole of the closing movement, and the breaker will thus trip free of the handle, whether operated automatically or by hand.

The free handle operates through a simple toggle movement fitted with accelerating springs and oil dash pots, so that a very high speed of break is obtained, with sufficient retardation at the end of the stroke to prevent any mechanical shock and consequent damage to the gear. This operating mechanism being completely immersed in the oil is self-lubricated, and is therefore protected from corrosion or undue wear. The gear is supplied in a draw-out or non-draw-out pattern, as required. The various parts of the gear are readily accessible for inspection, cleaning, adjustment, or replacement. This is particularly so in the draw-out pattern. Safety is ensured during any of these operations by means of the interlocking devices. A connection or isolating chamber (C) is provided to permit of the ready removal or replacement of the circuit breaker carriage without interference with the fixed electrical connections. The bus-bar chamber (D) acts as a terminal box for cable ends, or houses the permanent electrical bus-bars in the case of a grouped switchboard. Ample clearances and leakage surfaces have been arranged between all points where differences of potential exist; while all live parts not immersed in oil are embedded in compound as a final safeguard. A complete set of mechanical interlocks, incorporated in the design of the gear, ensures that the correct sequence of operations is followed when the gear is manipulated. A maximum of four trips can be supplied, comprising any combination of low-voltage, overload, earth leakage or trip-coil release; but only one low-voltage release can be fitted to each circuit breaker. All trips are of the solenoid type, and the coils are immersed in insulating compound.

WORKING CONDITIONS IN FACTORIES.

H.M. CHIEF INSPECTOR'S REPORT.

IN his annual report for 1921, which has just been issued,* the late Mr. R. E. Graves, H.M. Chief Inspector of Factories and Workshops remarks, *inter alia*, that, generally speaking, the circumstances existing throughout the period under review were such as to discourage the outlay of money in trade developments or the erection of new works; it is therefore of interest to note such developments as occurred. Amongst the more important mentioned in the reports from inspectors in various parts of the country are developments in rolling-mill plant in Sheffield for the production of tramway rails, &c., one firm having completed the erection of mills of the Mogran type capable of turning out 19,000 tons of finished steel bars and sections per month, while another, engaged in the mass production of tools and cutlery, is erecting its own Siemens steel plant and is installing electric furnaces. It is also reported from Sheffield that a new development in the manufacture of stainless steel is the production of an untarnishable metal of a ductile nature which can be worked cold into intricate shapes and can, therefore, be used for a multitude of purposes for which the original stainless steel is unsuitable owing to its hardness. It is expected that this new metal will, to a large extent, supplant copper and brass for a large variety of articles which require to be kept bright. The introduction of what is described as synthetic silver-nickel is also mentioned. It is said to be untarnishable and closely to resemble the best electro-plate, and that it can be produced at about half the cost of the latter. In the cutlery trade in Sheffield the introduction of grinding by machine methods is on the increase, and one invention is mentioned by means of which 112 table blade blanks can be ground at the same time on a cylindrical electromagnetic device. The only trades mentioned as having been fully employed are the food manufacturing trades generally, and particularly the sugar confectionery section. The only branch of the engineering trade which has been busy is the textile machinery section, which has been fully employed on both home and foreign orders. There is much leeway still to be made up in the home factories in replacing and repairing plant which was run almost to destruction during the war. The introduction of electricity for various industrial purposes continues on a large scale, particularly for driving small motors.

The inspectors have been at some disadvantage in making their reports this year because most of them were new to their districts, owing to the great number of changes which took place on August 1st last, consequent on bringing into operation on that date the reorganisation scheme mentioned in the report for 1920. The scheme was brought into operation with extraordinary smoothness, but the work of the department generally has been hampered by shortage of staff. In response to the demand for economy the authorised staff was reduced from 235 to 211; at the end of the year there were 20 vacancies, 11 of which, however, have been filled during the current year.

* H.M. Stationery Office, Cornwall House, Stamford Street, S.E.1; Cmd. 1705; price 3s. net

Notwithstanding the difficulties which have had to be contended with and the depressed state of trade, a large amount of useful work was accomplished during the year covered by the report.

Since its creation in January, 1921, the Engineering Branch has proved its usefulness. To each of the inspectors has been allotted certain particular subjects in which to specialise, and in this way the technical work is divided up and overlapping is avoided. They have been engaged on a number of very useful inquiries, such as those in connection with the manufacture of india-rubber, electric accumulators, &c.

The total number of effective visits paid to factories and workshops and other places under the Acts was fewer by 15,287 than in 1920, but a reduction was to be expected in view of the difficulties involved and the time occupied in making the arrangements for the new divisions and districts. Moreover, it must be remembered that every new code of regulations and order issued adds greatly to the work of the staff.

Notwithstanding the industrial stagnation which has prevailed, the registered factories have increased from 140,064 in 1920 to 142,749, while workshops (including men's workshops) have continued to disappear, there being 4,944 fewer than in 1920. Owing to the division of the district areas during the year certain statistical information previously given is not included in the report under review.

In the chapter on "Safety," Mr. H. J. Wilson, Superintending Inspector, records that during 1921, 92,565 accidents (including 951 fatal ones) were reported, as compared with 138,773 (1,404 fatal) in the previous year. This remarkable drop is almost entirely due to phenomenal inactivity in industry throughout the year, and the prolonged coal miners' strike, which resulted in many large iron mills and blast furnaces being completely closed down for an extended period. Concentrated attention has been given to crane accidents, and investigation has brought to light the important fact that a growing number of users insure their cranes, thus securing the benefit of periodical expert inspection, and defects, the result of wear and tear, are detected before danger arises. It is gratifying to find that electrical overwinding and overrunning devices are being largely adopted.

Two explosions due to ignition of dust were reported during 1921. In the first case, as the machine was almost entirely destroyed, it was difficult to trace the original cause. The most likely explanation seems to be that some foreign material, such as a piece of steel or stone, entered the feed hopper, and grinding against the cast-iron tube, caused sparking, which ignited the cloud of dust present in the screen chamber. Another possibility is that the ignition was due to an electric spark, caused by a static charge set up in the metal parts of the machine as a result of the friction of the driving belts and pulleys. With a view to minimising the risks of such explosions the following, amongst other, recommendations were made:—

All parts of the sieving machines to be effectively earthed.

Magnets to be used for the removal of any scraps of iron or steel from the powder fed into the hoppers.

The second dust explosion is supposed to have been caused by a small piece of flint causing sparking. The firm already had provided magnets in the feed hopper to stop any particles of iron.

In the chapter on "Industrial Diseases" Dr. T. M. Legge, Senior Medical Inspector, reports that the total number of cases of lead poisoning in the electric accumulator industry was 35, none of which proved fatal, as compared with 47, including 2 fatal cases, in 1920.

In the chapter on "Dangerous Trades," Mr. G. Stevenson Taylor, Senior Engineering Inspector, points out that, although the general trade depression has been felt in the electric accumulator, as in other, trades and some works have either been idle for a period or working short time, the incidence of lead poisoning has continued high, as mentioned above. In consequence Dr. Bridge and Mr. Price are at present engaged on an inquiry into the conditions existing in the industry with a view to the revision of the existing code. The present regulations were issued in 1903, since when considerable developments have taken place.

As a result of steady pressure by the staff considerable improvements have been made in the conditions in some works. Miss Sanderson (Ashton-under-Lyne) reports that the reduction of lead poisoning cases in one small works, from eight in 1920 to two in 1921, is due entirely to the improvements which have been made, and not to any falling off in output, as this firm has had plenty of orders. On the other hand, in the case of a very small accumulator works which had been started in most unsuitable premises in West London without proper notification, Mr. Pedlar reports that the financial state of the firm was very low, so that considerable difficulty was experienced in securing compliance with the regulations.

Mr. Butler (West London) draws attention to the advantages of the use of vacuum cleaning appliances for removing lead oxide dust. The result of analysis of the atmosphere where lead burning processes are carried on show that lead fumes are produced in sufficient quantity to be injurious to health, and this is confirmed by statistics of lead poisoning in

accumulator factories, as 31 per cent. of the cases are persons employed in lead burning. Efficient exhaust ventilation is therefore very necessary in connection with this process. Excellent plant has been installed in some works during the past few years, but owing to the state of trade progress has been slow in others.

With regard to electric lighting, Mr. Lloyd Edwards (Woolwich) finds that electric lighting is almost universal in the docks in his district, cluster lamps being mostly used and found satisfactory. Arc lamps are said to be less satisfactory, and complaints have been made that the direct glare from these affects temporarily the eyesight, and thereby increases the danger to persons moving about in certain parts of the docks. Very few contraventions have been discovered with regard to inadequate lighting on ships during loading or unloading, as these processes have not been carried on after dark so much as formerly. As regards the Clyde shipyards, instances are quoted of two or three cases of inefficient lighting between decks on ships.

In the chapter on "Health and Sanitation" Mr. E. A. R. Werner, Superintending Inspector, remarks that many inspectors express surprise at the little interest shown by employers generally in the subject of lighting; thus Mr. Verney (South London): "It is not usual to find an entirely satisfactory system of lighting." Inadequate lighting is provided at such hazardous points as the landings of lifts, and dangerous machines, such as power presses, are found in dark corners. Neglect of window cleaning is still a matter of frequent comment.

As regards artificial illumination, gasfilled electric lamps are now obtainable in smaller sizes than hitherto, and this should help towards better distribution. Screening of intense lighting still needs great attention, but employers are becoming more alive to this necessity. Obsolete means of lighting still persist in many places: Sheffield, Birmingham, and Norwich inspectors report the continued prevalence of batswing gas burners, and Mr. Brothers (Warrington), says workers still have to provide candles for themselves in many fustian-cutting works.

Miss Martindale, Superintending Inspector, reports that a considerable amount remains to be done to improve lighting conditions in basement workrooms. In approximately 78 per cent. of the rooms visited the natural light was insufficient to light the whole room, and in 65 per cent. there was insufficient light for working purposes. One of the most serious disadvantages of underground work-rooms is that in over 60 per cent. of them artificial light is continually necessary. The rental for a basement might be comparatively low, but a high bill for artificial light might more than counteract this advantage. The following types of lighting were observed to be used for artificial lighting:—

Electric metallic filament	46 per cent.
Electric half-watt type or gasfilled	15 ,,
A combination of the two types ...	10 ,,

In 71 per cent. of the workrooms electric light only was used for illuminating purposes, and this illustrates to what a great extent gas is being superseded for this purpose. Several cases were noticed where firms had installed, or were installing, systems of indirect general lighting. In one litho. factory inverted incandescent gas burners were being replaced by electric lamps. These were fitted with opal shades below the lamp and enamelled reflectors above. At the time of visiting the position and candle power of these lamps were being experimented with to determine how to ascertain the best results in the room. It was practically certain, however, that, in addition, local lighting would have to be supplied over the ends of the machines, as it was found that the general lighting was insufficient for the fine work which had to be done on the plates and stones. In a plating works this type of general lighting was also found, in addition to local bench lighting by electric metal-filament lamps. The lighting was not so general as was desirable in this case, on account of the low ceiling—about 8 ft. from ground—and it was found that the opal shades occasionally became broken, due to the same reason.

In the case of a tobacco works it was stated that this system had been installed in the basement, but that the result obtained was not so soft as desired. The firm therefore experimented, and its final arrangement, which was in use at the time of visit, and which produced apparently even light of a soft character, consisted of half-watt type lamps totally enclosed in cubes made of thick grease-proof paper. The usual system, however, of obtaining general lighting was by using half-watt type electric lamps, unshaded, and sometimes fitted with overhead reflectors, at the ceiling level, while local lighting was obtained by small-power electric vacuum lamps with shades at the head level.

Very few cases were noticed where the lighting was considered to be inadequate, and this is doubtless due to the fact that electric light was so largely used. In about 4 per cent. of the workrooms the lighting appeared to be insufficient for the purposes required, and in nearly all these cases gas was used as the illuminant. In many cases glare was present; there seemed to be several causes for it, the most general being the absence of the shade or its shallowness compared with the size of the electric lamp, and to the position of the light in relation to that of the worker.

STEAM RAISING BY ELECTRICITY.

THE use of electricity as a steam-raising medium appears at first sight to be commercially impossible, but reflection will show that hydro-electric undertakings, which are compelled to keep running, although the generators may be very lightly loaded, could often profitably employ their surplus energy for the purpose indicated.

In a paper read recently before the Engineering Institute of Canada, Mr. F. T. Kaelin, Chief Engineer, Shawinigan Water & Power Co., reviewed the subject at some length, giving details of what had already been accomplished, and notes on the installation and working of typical electrical steam-raising plant.

The low cost of the steam generator compared with other apparatus for the conversion of electricity into heat, and the wiring and control gear necessary for this equipment, is very much in favour of the electric steam generator. It can be shown that even in extreme cases where the load factor is comparatively high, for instance, in pulp and paper mills, that it is economically possible to turn the power which is used for six days, mainly for pulp grinding, into steam, which is always required in such places, either for manufacturing or heating purposes. It was shown in a recent investigation that the coal-saving during the 52 Sundays and three holidays would easily pay for the installation of the steam generator in less than one year. Power companies would benefit by selling their idle power at low rates to such consumers.

In the electric steam generator all the electric energy is converted into heat energy, the current passing through a metal resistance or through the water itself. The whole process of conversion is therefore governed by ohmic law. One kWh is equivalent to 3,412 B.th.u.; the total heat content of one lb. of steam at an absolute pressure of 150 lb. per sq. in. is 1,193 B.th.u. Assuming a feed-water temperature of 150 deg. F., the total heat to be supplied will be 1,193—(150-32) =1,075 B.th.u. One kWh will, therefore, produce 3,412/1,075 =3.17 lb. of steam, ignoring heat losses. The only losses are those due to radiation and to the discharge of a certain amount of water from the apparatus which carries away accumulated impurities in the feed water. By proper lagging heat losses may be reduced to from 1 to 4 per cent., depending upon the size of the generator. For larger sizes the efficiency may be about 98 per cent. On this basis 1 kWh will produce 3.10 lb. of steam. Under average conditions 1 lb. of soft coal of about 12,000 B.th.u. evaporates about 8 lb. of water; one ton of 2,000 lb. will, therefore, evaporate about 16,000 lb. of water. The electricity required to evaporate the same quantity is equal to 16,000/3.10=5,161 kWh=215 kW-days; in other words, 215 kW in an electric steam generator is equal to one ton of coal per day, burned under average conditions of boiler efficiency. Comparing the capacity of an electric steam boiler with that of a regular boiler in boiler h.p. the following relations are found: one boiler h.p. is defined as equivalent to the evaporation of 34.5 lb. of water, from and at 212 deg. F. per hour, and represents 33,479 B.th.u. per hour; 1 kWh is equal to 3,412 B.th.u., and at an average efficiency of 98 per cent. to 3,342 B.th.u. These figures are almost exactly in the ratio of 10 to 1, therefore an electric steam generator of 1,000 kW capacity is equal to a boiler of 100 boiler h.p.

Considering the construction of electric steam generators, the author states that generators of the metallic resistance type are only suitable for low pressures up to about 500 V, and are therefore not usually adaptable for very large outputs. The steam production is controlled by switching on and off a number of parallel circuits, and the combination of circuits in parallel or series connection. Generators of this type have been built of 1,500-kW capacity; these are of tubular construction, about 20 ft. long and 5.5 ft. in diameter. The space occupied by this type of generator is large compared with the steam generating capacity.

In the water-resistance type of generator the energy passes through steam-tight insulating bushings to a system of stationary electrodes partly submerged in water. This type of generator is known as the "Revel" generator; it has been in use, principally in Italy, Switzerland, and France, for the past 10 years, mostly in self-contained units up to about 700 kW. For any considerable amount of power only a three-phase a.c. system may be considered practical. For small generators, with voltages up to about 2,200, the container itself forms the neutral point of the three-phase system, and is earthed. For larger sizes, especially when the pressure is above 2,200 V up to 12,000 V, it will be advisable to split

up the generator into three single-phase units with three containers, each enclosing one electrode; the three containers again form the neutral point, and are metallically connected and earthed. The regulation of electrical input to suit the steam demand is effected by varying the resistance. The outstanding advantages of this type of generator are its simplicity of construction, compactness, ease of control, and its low cost per kW capacity. The variation of the resistance of water with its degree of purity needs careful consideration. The condensate is of very high resistance, but the addition of make-up water, usually drawn from a river, brings its conductivity up to a practical figure. It has been found by experience that the resistance of the water can be controlled over a considerable range by discharging a certain amount of water from the generator; the amount so discharged depends, of course, upon the degree of purity of the water.

Fig. 1 shows a section of an actual 5,000-kW generator. This consists of a cylindrical tank with an extension at the bottom. The upper part is flanged, and to it is bolted a dished cover, which contains three openings for the porcelain bushings insulating the three copper conductors leading to the electrodes. The insulator bushing consists of three parts: two corrugated sleeves, one outside and one inside the tank, and a tube inside these sleeves, which are held together by a shoulder and nut upon the conductor passing through them. The faces of the sleeves are parallel, and are made steam-tight with the usual rubber steam packing. The packing allows a certain adjustment for the difference in the expansion of porcelain and copper. The porcelain sleeves are subjected to considerable pressure, and are made rather heavy for mechanical reasons; they are also made to withstand a working pressure of 6,600 V between phases. The conductors support, through a system of adjustable links, the steel electrodes of curved plates arranged in a circle equidistant from two cylinders, one outside and one inside, forming the neutral point of the three-phase system, the outside one fastened to the generator shell proper and the inside one suspended from the cover, and well secured in a central position. Both these cylinders are electrically connected to the body of the generator and earthed. The arrangement shown is for 1,300 A at 2,200 V, 60 cycles, and for a working steam pressure of 165 lb. per sq. in. The current passes from both sides of the electrode to the inside and outside cylinders, and, to a much smaller extent, from electrode to electrode.

As the path of the current is not sharply defined, the ohmic resistance can only be calculated approximately. If R = ohmic resistance between electrode and earth; d = distance between electrode and ground in inches; A = total area of submerged part of electrode in sq. in; s = resistance in ohms per

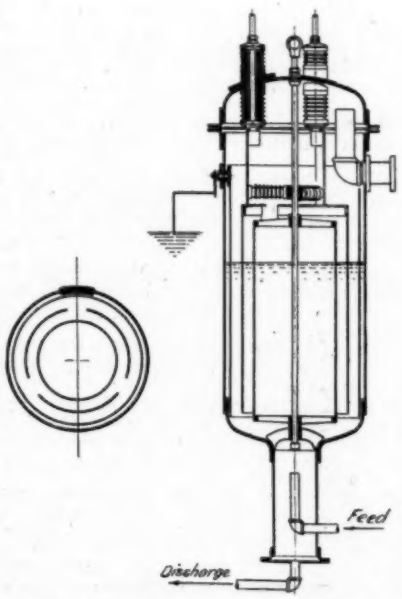

FIG. 1.—SECTIONAL DRAWING OF A THREE-PHASE SINGLE-UNIT ELECTRIC STEAM GENERATOR.

cu. in. of water at normal operation; E = voltage to neutral; I = current in amperes; P = power in kW, then a = current density = I/A; R = a/A; s = E/I; A = I/a, and E = d a s.

In the last equation the right-hand side is the product of three variables, the choosing of which is mainly a matter of experience and compromise to secure a satisfactory mechanical arrangement and safe operation. After d and a are chosen s is fixed—this means that for a certain load and water level the specific resistance of the water has to be maintained by adjusting the relative amounts of inflowing and outflowing water. The outside shell of the generator illustrated in fig. 1 is 42 in. in diameter. The length of the cylinder part is about 70 in., and it is designed to withstand a test pressure of 350 lb. per sq. in. The lower end is provided with an inlet for feed water and an outlet for the discharge and blow-off water. The generator is equipped with the customary water and pressure gauges and safety valves, and the tank is mounted on a steel frame.

The three-tank arrangement affords a very simple and mechanical design, and permits of a more accurate calcula-

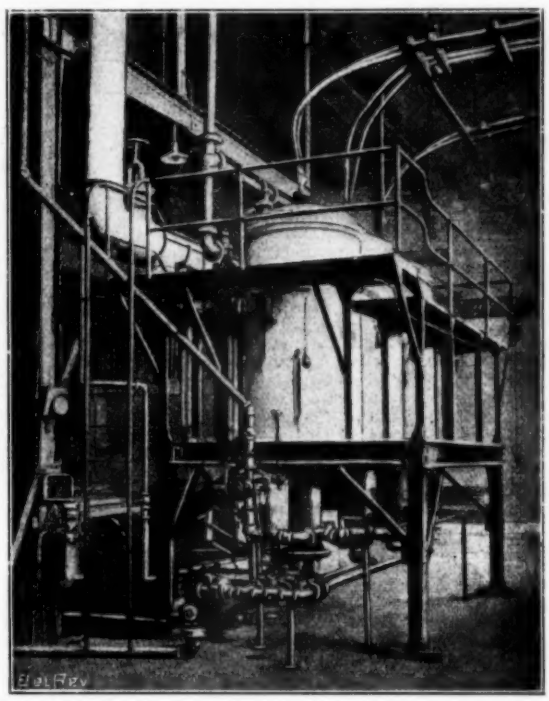

FIG. 2.—AN 18,000-KW, 6,600-V, THREE-PHASE, THREE-UNIT ELECTRIC STEAM GENERATOR.

tion of the ohmic resistance of one phase to earth. The resistance of a body of water between two concentric cylinders may be integrated and expressed as follows:—

$$R = \frac{s}{2\pi h} \log \frac{r_1}{r_2} = \frac{E}{I}$$

where h is the height of the cylinder; r_1 is the radius of the outside cylinder; and r_2 is the radius of the inside cylinder.

Fig. 2 shows a three-tank installation with a normal power input of 18,000 kW and a working pressure of 135 lb. per sq. in.

The floor space required by these types of steam generator is very small. The 5,000-kW generator, with control apparatus, can easily be placed in an area of 10 ft. by 12 ft., and the 18,000-kW type, equal to 1,800 boiler h.p., with all accessories, needs a floor space of about 15 by 22 ft. and headroom of 25 ft. for easy dismantling.

Operation is extremely simple for the small generator, and where the generators are not worked in parallel with other steam plant the operation can be made automatic by means of a regulating valve actuated by the pressure and controlling the amount of discharge water, thereby changing the water level, which, in turn, governs the power input and the steam production, and at the same time keeps the steam pressure constant. For the electrical control of the steam generator the usual apparatus—disconnecting switches, oil switches, and, preferably, three ammeters—is required. There are other advantages of the electric steam generator over the usual coal-fired boiler, for instance, any interruption in the supply of feed water simply means switching off the power, and does not introduce any danger. The usual blow-off valves, &c., are fitted, and in addition other electrical safety devices are provided.

The Rutenberg Concession.—M. Pinhas Rutenberg, the Russian who has obtained from the British Government a concession which will give him a monopoly in Palestine for the production of electricity, with the exclusive right for 70 years to utilise the waters of the rivers Jordan and Yarmuk and all their tributaries, arrived in London on July 10th from New York. He is reported to have written to the Colonial Office promising to pay English firms up to 10 per cent. above the prices for equipment quoted by firms in other countries. —*Daily Mail.*

THE "DAILY EXPRESS" WOMAN'S EXHIBITION.

THE devotion of an exhibition to the gentler sex possesses something of novelty, but the increasing interest of women in scientific housekeeping, as well as affairs outside the home, makes the success of such an organisation almost certain. The exhibition at Olympia, arranged by the *Daily Express*, opened on July 12th, and it is to be continued until the 29th. As is usual in every exhibition, the scope implied by the title has been broadly interpreted, and the show therefore includes both things of purely feminine interest and those whose attraction is not confined to the one sex.

Several electrical firms have taken advantage of the opportunity, but, so far as we could discover, electric cooking (meaning, of course, electric cookers of fair size) has been neglected, saving by a firm of furnishers (MESSRS. OETZMANNS), who show a "Magnet Mode" cooker with hot-plates and grills, and the HOTPOINT ELECTRIC APPLIANCE CO., LTD., which exhibits, not very conspicuously, a "Falco" electric cooker of the pattern described in our issue of July 14th. The latter firm has a comprehensive display of domestic electrical apparatus, including irons, percolators, kettles, toasters, &c., the principle feature of which is the thermostatic cut-out device which guards the appliances from destruction by overheating, and prevents waste when it is forgotten to switch off the current. The "Premier" suction cleaner is displayed. This can be fitted with a beating attachment, which is demonstrated, consisting of three light metal bars fitting and revolving in the mouth of the cleaner. These bars are provided with numerous small rubber "teeth" which act on the material being swept. The "Aerobell" washer which, by means of two cups, forces air and water through the fabric of clothes, &c., is also demonstrated. Another exhibit is the "Walker" dish-washer, illustrated in fig. 1, which is a metal cylinder, with water inlet and outlet, containing a basket to hold crockery. The washing is performed by the action of a propeller beneath the basket, operated by a small motor through a gear-box. The firm shows, in addition, "Hotpoint-Sheldon" vibro-massage and high-frequency apparatus.

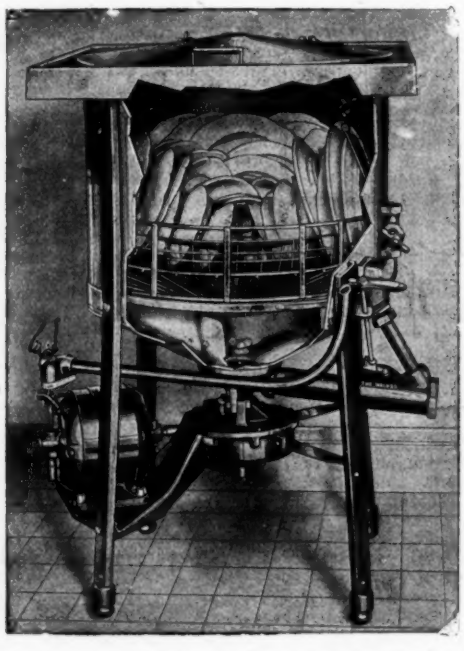

FIG. 1.—THE "WALKER" DISH-WASHING MACHINE.

THE WIN-SUM ELECTRIC CO. has on view and in operation a number of radiators similar to that described in our issue of December 23rd, 1921. This apparatus comprises a silently-running fan in combination with a four-part heating element and a deodorising screen. An adaptation of the device to an ice-box is shown and proved to be very effective. Figs. 2 and 3 show an attractive oak cabinet containing a "Win-Sum" radiator with the controlling switches. The door is prevented from closing by means of a bar below the switch dollies until the bar is raised, opening all the switches.

FIG. 2.—THE "WIN-SUM" RADIATOR CABINET.

FIG. 3.—THE "WIN-SUM" RADIATOR CABINET.

MESSRS. GILLESPIE & BEALES exhibit a number of "Nilfisk" suction cleaners (described in our issue of April 15th, 1921), which consist of portable receptacles embodying small electric motors, together with the necessary attachments. Four sizes are shown.

THE RADIO COMMUNICATION CO., LTD., has a ship's wireless receiving equipment in operation, by means of which concerts are given daily to large audiences.

MESSRS. PATHE FRERES have fitted up a studio equipped with powerful arcs, and they daily take films of dress displays, &c., for exhibition at a free kinema theatre in the building.

ELECTRICAL APPLIANCES, LTD., show many small electrical utensils, kettles, &c., as well as hot-plates and toasters. A speciality is a small hot-plate, really a miniature hot-cupboard, with top and bottom elements and a grill, by means of which both sides of a piece of bread may be toasted simultaneously. Double boiling rings are also shown; these have separate push-button switch control. Other exhibits upon this stand are a small wireless crystal receiving set with a ten-mile range, and a collection of "violet-ray" apparatus, the curative properties of which are much extolled.

On a stand arranged by the London gas companies appear gas "switches" and a plausible imitation of an electric iron for operation by gas.

A large collection of electro-medical apparatus by the MEDICAL SUPPLY ASSOCIATION, LTD., the SOLUS ELECTRICAL CO., J. J. GRIFFIN & SONS, and other firms, is displayed on the stand of the Royal Free Hospital. This includes X-ray equipment, high-frequency appliances, radiant heat and light baths, &c. THE ANGLO-CANADIAN TRADING CORPORATION, LTD., also shows a radiant-light bath device, consisting of a wooden frame, upon which tubular carbon-filament lamps are mounted, for fitting in an ordinary bath.

THE "NORTHERN" STEEL & HARDWARE CO. demonstrates the "Laundry Queen" electric washing machine and the "Northern" suction cleaner, and also exhibits numerous small appliances, including some fans and irons of German manufacture.

One attractive stand is devoted principally to the display of articles made by the men of ST. DUNSTAN'S, and among these are silk lamp shades and carved and decorated table and floor standards for lamps.

THE RAWLPLUG CO., LTD., has its usual collection of plugs and accessories, showing the applicability of the "Rawlplug" to all kinds of materials.

Numerous social welfare societies and similar organisations hold stands in the exhibition. Among these is the Coal Smoke Abatement Society, whose activities are of particular value to the electrical industry; the Industrial League and Council; the League of Nations Union, &c.

The annexe of Olympia has been attractively laid out as flower gardens, and the B.T.-H. daylight lighting scheme, mentioned on previous occasions, has been retained.

New Spanish Companies.—Under the style of Construcciones Electrotermicas (Sociedad Anonima) a company has been formed at Barcelona for the manufacture of all kinds of electric heating appliances.

Saltos del Rio Ondarroa is the name of a company embodied at Jemein, province of Vizcaya, to develop falls on the Ondarroa River for electrical purposes. Its capital is 1,455,500 pesetas in 500-pesetas shares.

There has been constituted at Madrid the Sociedad Anonima Termo-Electrica Andaluza, with a capital of 12,000,000 pesetas, contributed by Spanish and foreign capitalists, to install a thermo-electric plant at important coal mines in Cordoba to furnish electricity to towns in the provinces of Sevilla and Cordoba.

PHYSICS AND ENGINEERING.

THE second of the series of lectures on the importance of physics in the various industries which are being given under the auspices of the Institute of Physics was delivered by Sir J. ALFRED EWING on July 4th at the Institution of Electrical Engineers. The subject was "Physics in Engineering Practice, with special reference to Thermodynamics," and the chairman, very appropriately, was Sir CHARLES PARSONS, Vice-President of the Institute.

The lecturer introduced his subject by admitting that the routine work of engineering may require little knowledge of underlying principles, but the engineer who would leave the beaten track must take physical science for his constant guide. The impulse towards engineering progress will be given more and more by men who are physicists as well as engineers. Much can be learnt of the fascinating borderline which such men explore from the great "Dictionary of Applied Physics," now being issued under the editorship of Sir Richard Glazebrook.

The study of physics can influence the development of engineering in three main ways. The first is when a knowledge of physics determines the immediate creative work of the engineer—when an invention, using the word in the broadest sense, is made by a man who can bring physical knowledge to bear on the solution of a practical problem; examples are Kelvin's design of instruments, which made ocean telegraphy possible, or Sir Charles Parsons's invention of the steam turbine. Another way is when the physicist makes an advance in the principles of his science, which illuminate the operations of the engineer, systematising what was haphazard and vague. Many of the classical discoveries in thermodynamics come under this head, and a conspicuous example was the settlement, by a committee of physicists, of the electrical standards. It is by such steps that the theory of engineering progresses, and no better example could be given than the work of Osborne Reynolds—experimental and mathematical—on the nature of fluid friction, which formulated the distinction between stream-line and turbulent flow, on the process of lubrication and on the free expansion of a gas. No doubt engineering must always include much that is "rule of thumb," and there is an engineering intuition which is an invaluable possession. But as engineering grows more complex it becomes increasingly important to formulate systematic theory, and the formulation of such theory is little more than physics seen through selective glasses. In the third way progress in physics may affect the progress of engineering without intention on the part of the discoverer. Kelvin's work on the oscillatory discharge, Maxwell's discovery, and Hertz's detection of electromagnetic waves are outstanding examples of progress in physics later adapted—by others than the pioneers—to practical ends.

Sir Alfred Ewing quoted John Hopkinson as an example of a master-mind who had enriched engineering in each of the three ways by which physics can promote that art, since he possessed not only a practical talent, but he could grasp with rare power and precision a scientific principle and develop its consequences with the mastery of the mathematician. Hopkinson's invention of the three-wire system of distribution, his series-parallel control for electric locomotives; but, above all, his formulation of the principle of the magnetic circuit, which reduced dynamo design from chaos to a science—all of these exemplify in one man the various ways in which physics can aid engineering.

In another field, that of thermodynamics, or the science of energetics, in its service to engineering, the name of Kelvin is supreme. In a most graphic and interesting fashion Sir Alfred Ewing traced the growth of this science in its engineering aspect from the days of Watt—himself in the first instance a physicist—who invented the condenser, expansive working, and the indicator; through Carnot, who introduced the idea of the reversible cycle and by implication discovered the second law of thermodynamics without quite knowing the first; Clapeyn, a mathematician as well as engineer, who showed how Carnot's ideas could be applied in practice; Joule, who discovered the first law of thermodynamics; to Kelvin, who, as Sir William Thomson, in 1850 finally solved all doubts and difficulties, showed that the conclusions of Carnot and Joule were in perfect accord, and reared on the basis of both a complete science of energy, which, with amazing generality and power he fertilised all fields of physical action, flooding all with light. On parallel, but equally individual lines, came the work of Clausius and Rankine; all founders and master builders.

It was in their attempts to create a thermodynamical, yet practical, scale of absolute temperature that Joule and Thomson made their famous experiments on the passage of gases through a porous plug. The discovery of a small, outstanding cooling effect and the subsequent application of the theory of regeneration (also used by Stirling in heat-engines and Siemens in furnaces) enabled Linde, Claude and others, by liquefying the most refractory gases, to build up a great industry, in which the constituents of the atmosphere are separated, the oxygen put to various industrial and medical uses, the nitrogen used in the manufacture of fertilisers and valuable products, such as argon and helium, also isolated. From the same fundamental investigations in thermodynamics have arisen the important processes of refrigeration —first suggested by Thomson in 1847—processes which now make a continuous appeal, not only to thermo-dynamics, but to the results of researches in thermal insulation, convection, radiation, and hygrometry.

Passing briefly over the physical problems concerned with the development of the internal combustion engine—which, by the way, made aviation possible—Sir Alfred Ewing dwelt on the importance to the engineer of a knowledge of the properties of steam, which we owe primarily to the pioneer physical researches of Regnault, later theoretical work on the properties of fluids—the idea of "total heat" and "free energy," and the potential functions of Willard Gibbs—and finally, the remarkable work of Prof. Callendar, whose characteristic equation for steam and experimental tables have been indispensable in formulating a correct theory of the steam turbine. The invention of that machine by Sir Charles Parsons was itself but an attempt to bring Carnot's engines, or, in other words, complete reversibility, impossible in the reciprocating engine, nearer to reality, and it has revolutionised steam engineering.

Most of this splendid work was the achievement of the great Victorians, whom it is now the fashion to disparage in certain quarters. But there are giants still, concluded the lecturer. The present age is witnessing a wonderful efflorescence in physics. These new discoveries and new conceptions will in time also find their places in an ordered scheme, and in their turn will inspire the engineers whose business it will be to minister to generations yet unborn.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

18,238. "Electro-mechanical lamps for velocipedes, &c." A. Luzy. July 3rd.
18,245. "Amplification and transmission of sound waves by microphones." Soc. Coupleux Freres. July 3rd. (France, July 7th, 1921.)
18,246. "Sparking plug." H. G. Kardoc. July 3rd.
18,248. "Commutator dynamo-electric machines." P. C. Rushen (Siemens Schuckertwerke). July 3rd.
18,249. "Vehicle head lamps, &c." H. F. Jzoon and D. Lely and Naamloose Vennootschap Philips' Gloeilampen fabriken. July 3rd.
18,252. "Regulating devices for electric installations." Etablissements De Dion Bouton Soc. Anon. July 3rd. (France, July 30th, 1921.)
18,257. "Safety device for arresting trolley wire and automatically re-adjusting trolley thereto." E. E. Mathers. July 4th.
18,278. "Electrically-heated furnaces." J. Armstrong. July 4th.
18,283. "Electric lamp holders." G. O. Donovan and W. Donovan. July 4th.
18,284. "Electric lamp holders." G. O. Donovan and W. Donovan. July 4th.
18,310. "Arrangement for making connection to electricity meters," Landis and Gyr Akt. Ges. July 4th. (Switzerland, July 5th, 1921.)
18,321. "Undirectional current-carrying devices." Westinghouse Brake and Saxby Signal Co., Ltd. July 4th. (United States, March 7th.)
18,323. "Wireless telegraphy apparatus." A. H. S. MacCallum. July 4th.
18,327. "Relays." S. M. Day. July 4th.
18,328. "Colliery trams, &c." T. Rees. July 4th.
18,337. "Illuminated advertising devices." A. Wuillemin. July 4th. (Switzerland, July 4th, 1921.)
18,354. "Thermionic vacuum tubes." H. J. van der Bijl. July 4th.
18,358. "Electrical heating devices." British Thomson-Houston Co., Ltd. (General Electric Co.). July 4th.
18,359. "Loaded signalling conductors." Western Electric Co., Ltd. July 4th. (United States, August 16th, 1921.)
18,379. "Electric controller." W. Schwagermann and Ward Leonard Electric Co. July 4th.
18,380. "Rheostat." A. E. Waller and Ward Leonard Electric Co. July 4th.
18,384. "Appliance for attaching shades to holders of electric light fittings." A. J. Dunkinson and Jones Hast & Co., Ltd. July 4th.
18,414. "Electric transmission systems." A. M. Taylor. July 5th.
18,419. "Coin released electricity meters." P. F. E. Major, G. N. Miles and C. C. Smith. July 5th.
18,422. "Sparking plug tester." C. H. Mitchell. July 5th.
18,433. "Printing telegraphs." A. Gordon and Siemens Bros. & Co., Ltd. July 5th.
18,443. "Sparking plugs." E. E. E. Doue. July 5th.
18,461. "Electric incandescent lamps and holders therefor." H. Workman. July 5th.
18,480. "Rheostat." L. Kebler and Ward Leonard Electric Co. July 5th.
18,485. "Storage battery containers." R. E. Beswick and Fuller's United Electric Works, Ltd. July 5th.
18,486. "Electric lamps." Edison Swan Electric Co., Ltd., and P. Freedman. July 5th.
18,500. "Telephonic systems." International Callophone Corporation. July 5th.
18,501. "Control of wireless amplifying apparatus." C. F. Elwell, Ltd., and B. E. G. Mittell. July 5th.
18,505. "Spark gaps for ignition systems of internal-combustion engines." F. R. F. Ramsay. July 6th.
18,507. "Electric battery incandescent lamp set." W. A. Kimpton. July 6th.
18,538. "Electric door bell." T. Hewitt. July 6th.
18,549. "Electric switches." H. W. Cox. July 6th.
18,562. "Bayonet holders for electric incandescent lamps." C. F. Rainsford. July 6th.
18,567. "Welding electrode." Elyria Iron & Steel Co. and A. E. White. July 6th.
18,572. "Telephone transmitters." Western Electric Co., Ltd. July 6th. (United States, October 3rd, 1921.)
18,580. "High electrical resistances." H. St. G. Anson. July 6th.
18,583. "Means for making selective call signals." Soc. Francaise Radio Electrique. July 6th. (France, August 19th, 1921.)
18,587. "Metallic vapour lamps." P. Eversheim. July 8th. (Germany, July 10th, 1920.)
18,609. "Telephone receivers." S. G. Brown. July 6th.
18,613. "Wireless receiving and transmitting sets." G. K. Field. July 6th.
18,615. "Electrolytic anti-corrosion systems." A. S. Gush. July 6th.
18,623. "Device for use when setting contact points of magnetos, &c." C. D. G. Franklin. July 7th.

18,631. "Device for carrying armoured electric cables in underground workings." A. Leitch. July 7th.
18,633. "Electric pianos." F. C. Griffen. July 7th.
18,649. "Homopolar motors or generators." H. J. Boardman. July 7th.
18,678. "Crystal detectors for wireless telegraphy, &c." T. W. Hardy and W. G. Moie. July 7th.
18,680. "Wireless receiving sets." F. Collyer and A. de Solla. July 7th.
18,692. "Insulating devices for wireless installations." S. L. Forbes. July 7th.
18,693. "Insulating devices for wireless installations." A. Couldwell and S. L. Forbes. July 7th.
18,694. "Electric heating devices." British Thomson-Houston Co., Ltd. (General Electric Co.). July 7th.
18,709. "Metallic vapour lamp." P. Eversheim. July 7th.
18,722. "Electric switches, &c." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. July 7th.
18,723. "Dynamo electric machines." G. A. Juhlin and Metropolitan-Vickers Electrical Co., Ltd. July 7th.
18,724. "Electric motor converter sub-stations." Metropolitan-Vickers Electrical Co., Ltd., T. W. Ross and C. Ryder. July 7th.
18,734. "Dynamo regulator." F. H. Bullinger and Ward Leonard Electric Co. July 7th.
18,735. "Electric resistance device." A. E. Waller and Ward Leonard Electric Co. July 7th.
18,736. "Automatic controller." F. H. Bullinger and Ward Leonard Electric Co. July 7th.
18,737. "Rheostat." G. W. Camp and Ward Leonard Electric Co. July 7th.
18,738. "Rheostat." L. Kebler and Ward Leonard Electric Co. July 7th.
18,740. "Anodes for forming percompounds." G. Baum. July 7th.
18,742. "Electric measuring instruments." T. Mather. July 8th.
18,748. "Renewal, &c., filaments in thermionic valves." A. H. S. Colebrooke and W. A. Williams. July 8th.
18,763. "Electric resistance switches and motor starters." S. Slack. July 8th.
18,776. "Carbon holders for electric arc lamps." W. S. Gibson, T. Stark and B. Udall. July 8th.
18,792. "Electrically-heated devices." British Thomson-Houston Co., Ltd. (International General Electric Co. Inc.). July 8th.
18,816. "Signalling devices for motor vehicles." M. A. E. Dixon. July 10th.
18,830. "Electrically-operated clutch." T. Abel. July 10th.
18,836. "Electric conduits." W. Lumb. July 10th.
18,838. "Carbon holders for arc lamps." J. E. Phillips. July 10th.
18,851. "Demagnetiser for use with direct-current electricity." A. Hollingworth. July 10th.
18,873. "Automatic electric switching device." E. Magerle. July 10th. (Austria, July 21st, 1921.)
18,886. "Electrically-propelled vehicles." J. E. Hamilton and Industrial Appliances, Ltd. July 10th.
18,888. "Recording instruments." British Thomson-Houston Co., Ltd. (General Electric Co.). July 10th.
18,893. "Retinoscopic lamp." E. Seymour. July 10th.
18,916. "Apparatus for inspection and control of sparking plugs." Soc. Anon des Aéroplanes G. Voisin. July 10th. (France, July 11th, 1921.)
18,917. "Cathodes of electric discharge tubes." Ges. für Drahtlose Telegraphie. July 10th. (Germany, July 11th, 1921.)
18,919. "Electric signalling." N. P. Hinton. July 10th.
18,922. "Electric signalling." F. E. Pernot. July 10th.
18,928. "Process for electrolysis of zinciferous materials." F. Hansgirg. July 10th.
18,931. "Combined locking apparatus for distributing switch of electric lighting installations for motor cars." Scintilla. July 10th. (Switzerland, July 9th, 1921.)
18,932. "Spring electro-magnet armatures for electrical vibration regulators." Scintilla. July 10th. (Switzerland, July 20th, 1921.)
18,933. "Arrangements for intensifying ignition apparatus spark of magneto ignition." Scintilla. July 10th. (Switzerland, July 23rd, 1921.)
18,935. "Amplifiers." A. Benoit and H. H. Duchesne and J. L. Mathieu. July 10th.
18,948. "Automatic self-cleaning sparking plug." T. J. Spidy and G. Thursby. July 11th.
18,961. "Electric switches for motor vehicles, &c." A. G. Fenn. July 11th.
18,968. "Electrical control gear." R. H. Barbour and J. R. Walton. July 11th.
18,982. "Variable resistance for filament circuits of thermionic valves, &c." F. Akister. July 11th.
18,984. "Oxy-acetylene and electricity burning resisting material." C. Clarke and A. C. Jamieson. July 11th.
18,989. "Electric terminals." H. Rottenburg. July 11th.
19,004. "Thermionic valves, &c." W. J. Polyblank. July 11th.
19,012. "X-ray dose meter." M. A. Codd and X-rays, Ltd. July 11th.
19,021. "Automatic reclosing electric circuit interrupters." Metropolitan-Vickers Electrical Co., Ltd. July 11th. (United States, September 16th, 1921.)
19,024. "Apparatus for producing induced electric currents." R. J. T Jefferson. July 11th.
19,026. "Method of cooling electric machines." H. Klug. July 11th.
19,030. "Electric switch." J. B. McDowell. July 11th.
19,032. "Thermal switch adaptor or coupling for incandescent electric lamps." F. H. Eeles. July 11th.
19,040. "Telegraph systems." Western Union Telegraph Co. July 11th. (United States, April 28th.)
19,043. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). July 11th.
19,044. "Automatic safety device for electric connections." J. Hoffmann. July 11th.
19,060. "Electrical switching apparatus." Siemens and Halske Akt. Ges. July 11th. (Germany, September 13th, 1921.)
19,063. "Recording of sound records." Metal Recording Disc Co., Inc., and A. E. White. July 11th.
19,086. "Tuning control devices for wireless receiving sets, &c." C. B. Brook. July 12th.
19,089. "Electric lighting systems." W. Brooke. July 12th.
19,110. "Trolleys for electric tramways." F. McLoughlin. July 12th.
19,113. "Triode valve vacuum tubes." A. S. Cachemaille (Westinghouse Electric and Manufacturing Co.). July 12th.
19,115. "Wireless tuning coils." H. W. Headland and Headland and Headland. July 12th.
19,122. "Electric controllers." R. Amberton. July 12th.
19,125. "Ignition systems." M. Mallory. July 12th.
19,126. "Apparatus for testing spark plugs and ignition circuits." S. Cooper. July 12th.
19,142. "Liquid-cooled electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). July 12th.
19,143. "Dynamo electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). July 12th.
19,144. "Electric induction apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). July 12th.
19,170. "Reception and amplification of radio-telegraphic signals." Ges. für Drahtlose Telegraphie. July 12th. (Germany, July 13th, 1921.)
19,174. "Electrical and thermal insulator and process of manufacture thereof." A. A. Samuel. July 12th. (France, August 1st, 1921.)
19,183. "Electric multiplex communication." T. Oguti. July 12th. (Japan, December 15th, 1921.)
19,186. "Illuminating devices." University of Dayton Society of Mary. July 12th.
19,187. "Illuminating devices." A. E. White (University of Dayton Society of Mary). July 12th.
19,197. "Manufacture of tungsten." E. N. Craig, Durelco, Ltd., and R. E. Pearson. July 12th.
19,244. "Electric switches." S. Milburn. July 13th.
19,251. "Control circuits." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 13th.
19,259. "Self-starters for motor vehicles." M. Evans. July 13th.
19,264. "Sparking plugs." M. Bailly. July 13th.
19,277. "Resistance control devices." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). July 13th.
19,279. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). July 13th.
19,284. "Apparatus for recording, reproducing, and obliterating sound waves in telephony, &c." F. H. Smith. July 13th.
19,304. "Coil-holders for wireless telegraphy, &c." H. L. Thomas. July 13th.
19,306. "Electric ignition in explosion motors." E. von Lepel. July 13th. (Germany, July 21st, 1921.)
19,307. "Telephone systems." Siemens and Halske Akt. Ges. July 13th. (Germany, July 13th, 1921.)
19,334. "Coil mountings for wireless telegraphy, &c." A. W. Knight. July 14th.
19,344. "Electric furnaces." F. I. A. T. Soc. Anon. July 14th. (Italy, December 23rd, 1921.)
19,357. "Appliance for heating liquid electrically." C. A. Morton. July 14th.
19,370. "Sparking plugs." E. J. Buckingham. July 14th.
19,433. "Automatic exchange telephone apparatus." W. Stott, Telephone Manufacturing Co., Ltd., and A. F. Ward. July 14th.
19,434. "Automatic exchange telephone apparatus." W. Stott, Telephone Manufacturing Co., Ltd., and A. F. Ward. July 14th.
19,435. "Automatic telephone systems." W. Stott, Telephone Manufacturing Co., Ltd., and A. F. Ward. July 14th.
19,436. "Automatic exchange telephone apparatus." W. Stott, Telephone Manufacturing Co., Ltd., and A. F. Ward. July 14th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

34,290. "Diaphragms of sound-recording and reproducing instruments." W. E. Clifton, J. S. Ewart, and Cliftophone, Ltd. June 3rd, 1921. (181,142.)

1921.

3,709. "Wireless telegraph calling or alarm devices." T. D. Parkin. January 31st, 1921. (Cognate application, 24,652/21.) (182,155.)
6,868. "Electrical apparatus for producing at a distance indications of the rotation and direction thereof of rotatable shafting and the like, particularly propeller shafts of ships." Mechans, Ltd., and H. Mechan. March 2nd, 1921. (182,161.)
8,730. "Means for generating continuous electric oscillations." C. S. Agate and P. W. Williams. March 21st, 1921. (182,168.)
9,125. "Electromagnets." Relay Automatic Telephone Co., Ltd., and W. D. Edwards. March 25th, 1921. (182,184.)
9,176. "Holders for electric lamps." G. E. Tate and F. O. Monkhouse. March 24th, 1921. (182,194.)
9,188. "Method and means for regulating the degree of vacuum in X-ray tubes." Sir H. Jackson, A. J. Philpot, and British Scientific Instrument Research Association. March 24th, 1921. (182,195.)
9,322. "Electric dry battery cells." Dr. A. Aron. March 29th, 1920. (160,807.)
9,552. "Wireless telephony." R. Whiddington. March 31st, 1921. (182,218.)
9,634. "Process for producing combined records of optical images and sound vibrations." E. Reisz. September 22nd, 1920. (Patent of addition not granted.) (169,424.)
10,057. "Liquid electric controller." R. F. Baerlocher. April 5th, 1921. (182,227.)
10,181. "High-frequency telephone systems." Ges. für Drahtlose Telegraphie. April 9th, 1920. (161,521.)
11,312. "Telephone repeaters." Western Electric Co., Ltd. (Western Electric Co., Inc.). April 19th, 1921. (182,244.)
11,877. "Means for heating the filaments of thermionic devices." Ges. für Drahtlose Telegraphie. April 24th, 1920. (162,288.)
11,879. "Stethoscopic appliances for detecting faint sounds or for reducing the intensity of transmitted sounds." J. A. Scharf. July 16th, 1920. (166,512.)
11,945. "Electrically-heated vaporizer for internal-combustion engines." F. J. Reed and J. S. Reed. April 26th, 1921. (182,253.)
11,981. "Electro-pneumatic relays for organs and like instruments." J. H. Crompton. April 26th, 1921. (182,254.)
12,174. "Train-control systems and time-element devices for use therewith." Automatic Telephone Manufacturing Co., Ltd., A. E. Hudd, and A. F. Bound. April 28th, 1921. (Addition to 175,733.) (182,259.)
12,240. "Means for mounting and driving dynamo-electric machines used with internal combustion engines." J. White. April 28th, 1921. (Cognate application 24,035/21.) (182,260.)
13,730. "Apparatus for heating forgings and the like by electricity." Dagobert, Timar & Co. December 22nd, 1920. (173,468.)
14,206. "Sockets for electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). May 21st, 1921. (182,279.)
14,442. "Electro-magnetic long-distance switch." G. Matt. May 24th, 1921. (182,282.)
14,563. "X-ray apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). May 25th, 1921. (182,287.)
17,338. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). June 25th, 1921. (182,315.)
17,676. "Shade-retaining ring for electic lamp sockets." H. H. Bennett. June 29th, 1921. (182,317.)
17,802. "Electrical insulators." G. V. Twiss. June 30th, 1921. (182,321.)
18,860. "Control systems and apparatus for air compressors." British Thomson-Houston Co., Ltd. (General Electric Co.). July 12th, 1921. (182,333.)
19,350. "Electrical control systems." R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. July 18th, 1921. (182,336.)
19,942. "Electric cables." L. R. Lee. July 25th, 1921. (Addition to 164,965.) (182,339.)
19,947. "Electric cables." L. R. Lee. July 25th, 1921. (Addition to 164,965.) (182,340.)
21,108. "Electrically-operated indicators." S. Webb. August 9th, 1921. (182,348.)
21,109. "Electrically-operated indicators." S. Webb. August 9th, 1921. (182,349.)
21,864. "Safety systems for electric networks." Naamlooze Vennootschap Lijn Protecte Maatschappij Tot Exploitatie van Electrotechnische en Andere Octrooien. September 16th, 1920. (169,149.)
23,594. "Miners' electric safety lamps." A. P. Ford. September 5th, 1921. (Patent of addition not granted.) (182,364.)

1922.

2,479. "Ignition devices for internal combustion engines." R. Bosch Akt. Ges. January 29th, 1921. (174,633.)